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THE FUTURE OF ELECTRIC-RAILWAY SECURITIES.

It is not generally known by the public that the electric railway industry has passed successfully through a great crisis within the past three years, but such is the simple fact. Until very recently the outlook for continued prosperity in the traction field was distinctly disquieting on account of the failure of the public to understand the difficulties surrounding the management of electric transportation properties, the restrictions of fare limits, increasing cost of operation and absence of the present kind of scientific administration which is doing so much to maintain dividends in the face of serious financial obstacles. How much the situation has changed for the better is well evidenced by an article in the current issue of *Rollins Magazine* by President William A. Bancroft of the Boston Elevated Railway Company on "The Future of Electric Railway Securities."

The author's able administration of the great Boston system for many years peculiarly qualifies him to discuss the electric-traction situation, and it is important to all workers in the electrical field to realize that the clouds which recently threatened this great branch of the industry are beginning to pass away. The reasons for this improved outlook may not be set forth in detail here, but in general they fall under the heads of increased efficiency of operation and a better feeling on the part of the public. The former is being secured by improved methods of studying the movement of cars, better shop service, centralized production and more efficient distribution of power, use of car designs closely related to traffic requirements and provision for the handling of a safer service. The increased public good will, on the other hand, arises from greater efforts to treat employees fairly, from the provisions now made to remove the anxieties of the future from the rank and file who have given the best years of their lives to the traction organizations, from comparison of transit conditions in Europe with those of America, from a growing appreciation of the stake the suburban householder has in the prosperity of the street railway, and perhaps above all, from the new attitude of electric-railway managers in regard to publicity. More and more the public is being made acquainted with the problems of electric traction, the plans and difficulties of the organization which handle the traffic of the cities on a restricted fare, through the practice of the managements of taking the community into their confidence. And the upshot of it all is

that for many years to come the electric traction field offers the conservative investor an attractive source of income, one in which nothing spectacular appears likely in the way of a return, but one which combines the safety of the principal with a revenue superior to that of first-class municipal bonds.

Recent increases in the fare unit outside the large cities have been accepted by the public after due demonstration of their necessity, and this fact, combined with the points discussed by President Bancroft, augurs well for the future of the industry. It would be a great calamity were it otherwise, since statistics show that every man, woman and child in the United States is now represented by an investment of nearly $50 in electric transportation. Among the great problems of America in the making, it is cause for profound congratulation that the darkest hours of the electric-railway industry appear to have passed away and that a new day is dawning for this very important necessity of civilization.

OPERATING RESULTS IN SMALL TURBINE PLANTS.

The process of standardizing production costs in newly established steam-turbine plants is one of much interest to those in a position to determine the real figures. In the early days of such service it is seldom possible to obtain the economies which may be realized after the installation has been brought under the conditions of routine inseparable from the carrying of responsible loads. Usually the machinery is placed in temporary service to help the older plant meet severe demands, and often the station output from the new equipment is irregular and consequently below the highest attainable efficiency for many months at a time. Boilers are run below normal pressure and ratings; engines, turbines and auxiliaries are "tried out" piece by piece, so that the complete articulation of the plant equipment and the full utilization of its service generally come long after the machinery is first turned over and permitted to supply current to the system.

It is with more than ordinary concern, therefore, that the records of station service are analyzed when sufficient time has elapsed to enable the management to make use of every opportunity to handle the new machinery effectively. The results of the past year's operation of two neighboring steam-turbine plants of 2,500 and 4,000 kilowatts capacity are significant in this connection. The two stations are each about three years old, both being equipped with water-tube boilers, mechanical coal-handling apparatus and vertical turbo-alternators. The smaller station delivered 5,764,466 kilowatt-hours to the busbars last year, the total sales of energy being 4,316,984 kilowatt-hours. The maximum load during the year was 2,355 kilowatts, giving a station load-factor of twenty-eight per cent. The company sold last year to users of electric power, 1,230,960 kilowatt-hours, and the plant consumed 7,726 tons of bituminous coal at a cost of $3.67 per ton. The fuel was delivered to the coal-handling system from barges on tide-water, and the net station cost of production, covering only the principal items of fuel, oil, waste, repairs and operating wages, was $51,840, or 0.90 cent per kilowatt-hour.

The results at the larger plant were closely comparable, the net manufacturing cost, exclusive of all fixed charges, distribution and other expenses outside the station walls, being $83,723, or 0.89 cent per kilowatt-hour. The output in the second case was 9,400,686 kilowatt-hours, or sixty-five per cent more than in the smaller station. The total sales were 7,156,247 kilowatt-hours, and the power sales were 1,333,675 units. The maximum load was 2,900 kilowatts, giving a load-factor for the year of thirty-seven per cent. The fuel consumption was 12,129 tons at $4.58 per ton.

Both stations have reached an operating figure representing results far superior to those obtaining in the older plants which they have superseded, comparatively few stations in the territory having been able to cut their bare operating costs under one cent per kilowatt-hour. It is noteworthy, however, that the larger plant was greatly handicapped by the high relative cost of its fuel per ton, the difference amounting to over $10,000 for the year. The company is paying dearly for locating the larger plant at an inland point where all fuel must be handled by rail, in comparison with the results obtained in the smaller station. The fuel cost per kilowatt-hour in the larger plant was 0.59 cent, that in the smaller station being 0.49 cent. Labor costs were 0.7 and 0.23 cent respectively. The smaller plant had 16 and the larger 19 men on its payroll. In neither case was the sale of electric power developed to the full possibilities of the district, and this opens the way toward a still larger service in the future. The results at the smaller stations show that a new turbine plant in good working time can produce current at very satisfactory figures, provided the output is relatively large, the cost of fuel moderate, and the machinery carefully handled in relation to the load. Those in the larger plant also show that large total output is a controlling factor in station economy, even where the facilities for fuel-hauling are handicapped by expensive methods of transportation. Taken together, the figures show that after a year or two of service each company is reaping the reward of building new generating facilities, providing for the expansion of output as consumers' demands grow, and utilizing efficient arrangements of main and auxiliary units to secure an excellent station cost taken from coal pile to busbar. The labor cost per unit of energy delivered at the switchboard is certain to fall off relatively as the plant output increases, and the fuel requirements will scarcely increase in proportion to the demands upon the stations. Taking all the factors into consideration, it should be possible to reduce the unit cost still further in the future, bringing each station within three or four mills of plants of five or ten times their capacity.

ELECTRIC POWER FOR PUMPING.

The use of electric motors for pumping water is largely on the increase, as the advantages of motor drive for this purpose are becoming very generally realized. The desirability of a pumping load for the central station is hardly to be questioned except under certain circumstances of municipal supply. Such a load has usually a low maximum demand and the hours of use are long, thus providing a high load-factor. Moreover, it is usually possible to control the time during which the maximum demand is utilized, and thus the total peak load on the power plant is not augmented by securing such a new customer.

Where pumping is made use of for irrigation purposes, not only may the time of maximum demand be controlled and the load usually shut off during the peak hours, but the season of greatest load usually comes at a time of the year when the lighting load is near its minimum. On the other hand, during the winter months when the lighting load reaches its greatest value there is little or no occasion for pumping water for irrigation purposes.

Most opportunities, however, for a central station to acquire a pumping load will be in connection with a supply of water to municipalities. Whether the load can be regulated in such cases will depend largely upon the water system which is being used. Where adequate capacity in reservoirs exists it will usually be possible to make arrangements for cutting off the pumps during the hours of peak load on the central station. Where reservoirs are not in vogue and standpipes are used to regulate and maintain the pressure, it is necessary, on account of the very slight capacity of the latter, to give almost continuous service to the pumps. The latter are then shut down or run at light load only at times of minimum water consumption, and this is not usually coincident with the time of peak load for the central station. Throughout a large part of the Mississippi Valley and other regions of the country which are quite flat, little use is made of reservoirs, and municipal water systems come very generally in the latter class.

The rate which may be offered to a municipality for pumping purposes should receive careful study by the central-station manager. In many cases a very low rate can be given, but this will depend upon individual circumstances governing the case, and especially upon the necessity for continuity of service. It is necessary in this case for the manager to know just what is the cost to the company to manufacture power at the time of peak load, and the cost to manufacture off-peak power.

In some cases where there is no reservoir and continuity of service is required, it has been found advisable to have a steam pump as a stand-by and as a peak-load accessory. Central-station electric power is used up to a certain maximum demand and at certain hours agreed upon in the contract, and when it is found necessary to use greater power than this contract permits at the minimum rate, the steam unit is put into action rather than to pay the increased price per unit which would be required for the excess power.

In other cases where the steam pump is considered desirable for regular service it has been found advantageous to provide an electric pumping unit as a reserve which shall be ready in case of emergency, or for service during repairs or shut-downs of the steam unit. The provision of such duplication of service usually enhances the reputation of electric service in general, and may well bring in sufficient revenue to make it desirable to the central station to provide the necessary connection.

Rates of insurance for an entire municipality are often dependent upon the nature of its water supply, since an inadequate or uncertain supply of water is regarded as constituting an excessive fire hazard. It will, conseqently, be considered advantageous by municipalities to have a source of power for pumping which will not be liable to any discontinuity due to exceptional circumstances. It is frequently worth while on this account to run duplicate service wires by different routes from the central station to the pumping plant, so that if trouble arises on one line from fire or otherwise, it will still be possible to furnish power for the pumps. The effect upon insurance and upon similar considerations obviously depends upon the existence of reservoirs with sufficient storage capacity. Where such reservoirs do not exist, it may be often inadvisable for a central station to contract for electric pumping service until its conditions of operation are such that it may anticipate absolute continuity of service.

The effect of a breakdown at the central station or on a transmission line which interrupts the supply of water to a town, especially if this happens at the time of a great conflagration or other serious need, might give electric service a reputation which would be hard for the central station to live down, and the possibilities of such injury may be greater than the profit to be derived from the pumping contract.

POINTS OF CONTACT WITH THE PUBLIC.

During the recent convention of the H. M. Byllesby Companies in Chicago one of the most interesting and pertinent addresses was devoted to an analysis of points of contact on the part of the public-service company with the public. It was pointed out that where every effort is made to give the patrons of the company good service, to extend every courtesy, and to make it a hard and fast rule that every employee be drilled to realize his responsibility, that a feeling of good will is engendered, and the patrons actually take a personal interest in the fortunes and growth of the company. This is in no sense a theory so far as the Byllesby companies are concerned, the remarkable success of this great organization supplying the electrical energy, steam heating, water, gas and telephone service for over a hundred communities attesting to the soundness of this policy when it is honestly put into practice.

Electrical League of Cleveland Holds Luncheon.

The Electrical League of Cleveland held its regular fortnightly noonday luncheon on January 5 at the Gillsy Hotel. Philip S. Dodd, secretary of the Commercial Section of the National Electric Light Association, gave an interesting address on "The Probabilities of Co-operation," describing the co-operative work carried on by the various electrical asociations throughout the country, including that of the Commercial Section of the N. E. L. A. In the course of his talk he made several timely remarks as to the probabilities of practical co-operation among the Cleveland electrical interests.

In this connection Mr. Dod mentioned the good work already accomplished in the matter of electrical advertising through the medium of the People's Electrical Page. He discussed the question of maintaining the municipal inspection code and the advisability of the League co-operating to effect standardization in street-lighting units. The formation of committees to give attention to conventions and electrical exhibits and to working out some system for popular education in electrical subjects was recommended as activities in which the Electrical League might profitably become engaged.

Announcement was made regarding the features which the entertainment committee of the League has in hand for the coming National Jobbers' Association convention. The chairman of this committee, H. H. Cudmore, incidentally stated that they were arranging an entertainment. The usual interest of the League members in these luncheons was indicated by the large number present; the attendance was 150.

Nela Engineering Society Meeting.

On the evening of January 4, J. W. Tabb, who has recently returned from South America, where he spent several months investigating the trade opportunities in Brazil and the Argentine Republic, addressed the Nela Engineering Society. Mr. Tabb discussed the credit and trade conditions, the shipping facilities, and in general, the methods of doing business in South America.

New England Section to Meet in March.

The annual meeting and convention of the New England Section, National Electric Light Association, will be held at the Hotel Kimball, Springfield, Mass., March 14 and 15, 1912. Five very interesting papers will be presented and discussed at this convention, the titles being: "The Use of the Electric Vehicle in New England"; "Report of the Rate Committee"; "Load-Factor and Power-Factor, How to Improve Them"; "Exhaust-Steam Turbine Applied to Electric Lighting"; "Should the Central Station Maintain a Wiring Department?"

Annual Meeting of the Western Association of Electrical Inspectors.

The seventh annual meeting of the Western Association of Electrical Inspectors will be held at the Plankinton House, Milwaukee, Wis., January 23, 24 and 25. The first session will be on Tuesday at 10 a. m. and will include the address of the president, V. H. Tousley, and the reports of committees. There will be an address by H. B. Long, engineer of the Tennessee Inspection Bureau, entitled "The Pro-Protection of Buildings Against Lightning." There will also be at this session a general discussion by the members regarding the improvements which have been made in the regulation of electrical hazards during the past year.

At the meeting on Wednesday there will be addresses by W. J. Canada on "Grounding of Conductors and Conduit," and by W. G. Middleton on "Electrolysis."

At the meeting on Thursday morning there will be an address by Franklin H. Wentworth, secretary of the National Fire Protection Association, entitled "Reminiscenses of a Pioneer Electrical Inspector." There will also be a discussion of problems arising in electrical inspection work.

Among committee reports will be one on "Outside Wiring" by Waldemar Michaelson; on "Underground Systems" by Hugh T. Wreaks; on "Electric Traction Systems" by Frank R. Daniel.

There will be a complimentary dinner to the members on Tuesday evening.

Edison to Provide Storage-Battery Cars for Test on Illinois Central.

During his visit to Chicago last week to attend the Byllesby convention and banquet, Thomas A. Edison held a conference with officials of the Illinois Central Railroad at which the long proposed electrification of the Chicago terminal of that road was discussed. As one of the most serious objections to electrification has been assumed by the Chicago railroad officials to be the danger of use of a third rail or trolley, Mr. Edison readily convinced them of the desirability of thoroughly testing out several storage-battery cars equipped with the latest Edison batteries. Three of these cars are to be built and shipped to Chicago for trial in a few months. They will be specially adapted for rapid charging of the batteries.

Peoria Electrical Show.

The first annual Peoria Electrical Show will be held in the Coliseum, Peoria, January 22 to 27. The Coliseum has a seating capacity of 7,000, and a ground floor space of 15,360 feet. About eighty per cent of the booth space is already allotted, and it is expected that the doors will open with every bit of space represented by an exhibit.

The exhibits will be devoted principally to demonstrations of electrical apparatus for domestic and industrial application. There will be an exhibit by the National Bureau of Standards and a Government exhibit indicating the use of electricity on shipboard and as a means of communication. There will also be a students' exhibit, consisting of wireless telegraph apparatus, and other amateur material. The Peoria Gas & Electric Company will have a large exhibit and will make special demonstrations of the use of cooking apparatus and the application of general utility devices.

On January 24 and 25 the convention of the Independent Telephone Association of Illinois will be held, and on January 26 there will be a Rejuvenation of the Sons of Jove.

Spencer's Military Band has been engaged for the entire week, and Miss Blanche Mahaffey will render a vocal concert afternoon and evening.

People's Electrical Page Advertisers Dine.

That co-operative electrical advertising through the medium of the "People's Electrical Page" in the daily papers is heartily endorsed by the electrical men of Cleveland was quite evident from the discussions that took place in regard to this question at an informal dinner tendered by Philip S. Dodd and M. E. Turner at the Cleveland Athletic Club rooms Saturday afternoon, January 6, to the 41 advertisers who have contributed to the electrical page in Cleveland. Those who spoke expressed enthusiastically their sympathy for co-operative advertising and the unanimous opinion prevailed that it was the only logical way of securing the greatest returns from advertising appropriations. Particular emphasis was placed on the cumulative advertising value of the electrical page by which future results would be assured through the gradual education of the public in the use of electricity.

Annual Convention of the American Institute of Electrical Engineers.

It has been decided to hold the annual convention of the American Institute of Electrical Engineers, which has already been announced for Boston, Mass., from June 25 to 28.

Henry J. Gille.

Time was, not so very many years ago, when the only apparent road to high attainment in electrical undertakings led by way of the technical and purely engineering departments. In no sense has the importance of technical training and engineering ability been diminished, and, in fact, the opportunities for the high-grade technical men are greater today than ever before. But there has come into the intimate family relation of the public-service company an element which, a dozen years ago, was considered an outcast and not at all of the class entitled to a part in the development of the destiny of the institution. For a long time so technical were the aspects of producing electrical energy that even the most enterprising once regarded the sale of this commodity as a purely technical proposition, and surrounded it with anything but commercial features.

Suddenly some one discovered that the managers of central stations were behind the times in their methods of appealing to their patrons for support. Once the idea was understood the forming of new business departments and the throwing of influence of every description toward the support of publicity campaigns took hold and the sweep of the new business idea was like that of fire in dry grass.

But, as we said before, the production of electrical energy is a technical proposition, and, to be true, the handling of electrical energy as a commercial proposition is technical also. In every direction high-grade advertising men and publicity experts have assisted in preparing literature of every description, laid out formidable data-books, systems and propaganda for the benefit of the central-station manager. The most successful, however, of all those who are devoting themselves to the creating of modern merchandising ideas in the introduction of electricity for every domestic and industrial application, are the men who have been trained in the works and are also gifted with a special sense that allows them to combine their practical and technical training with the subtle knewledge that constitutes an advertising idea.

When Henry J. Gille, after passing through the public schools of Washington County, Minnesota, and Curtiss College, entered the employment of the Columbia Electric Company, in 1889, he had no idea whatever that he would be interested some day in inducing people to use electrical apparatus. He worked in the factory, the storeroom, and the office, and he picked up a whole lot of information that seemed immaterial at that time, but which later he was to call upon in a good many instances, and because of this intimate acquaintance with the seemingly trivial things he succeeded where a man less well informed would have fallen down. So well did he apply himself to the job in hand that he soon found an opening as assistant purchasing agent of the Northern Thomson-Houston Electric Company. In 1891 he was made purchasing agent. Three years later he became assistant manager of the supply department of the General Electric Company, and in 1895 he was made electrical engineer of the Washburn & Moen Manufacturing Company. In 1898 he became manager of the electrical department of the St. Paul Gas Light Company, and the Edison Light & Power Company. In 1901 he was made general superintendent, holding this position until 1907. This is the character of the training which the companies and the men themselves worked out, involuntarily, and without the knowledge that it would become so valuable when applied in commercial directions. A keen sense of what the public wants, a desire to be of service all the time, and a wide outlook upon all the features which go to make up successful service characteristics fitted Mr. Gille in a unique way for the position of commercial agent of the Minneapolis General Electric Company, to which he was appointed June, 1907.

Mr. Gille's work in this position is a reflection of the really special training he had secured in the other, and, at first sight, hardly related departments of effort. His ideas upon business building and with respect to company relations with the public; his knowledge of power applications, and the possibilities of the utilization of electrical energy, have brought him into prominence on a number of committees of both state and national electrical organizations. His active participation in developing the commercial side of electrical development has made him conspicuous among his fellows, and at the last meeting of the executive committee of the Commercial Section of the National Electric Light Association he was elected chairman for 1911-1912. This section will place before the Seattle convention in June one of the most valuable programs so far as commercial developments are concerned, that has ever been given to a technical organization. Thus is it come about that the discipline and exactness of the technically trained man is turned to the account of higher efficiency in the selling organization of the electric light and power company. It is the correlating of the facts of so much illuminating intensity per square foot and the individual taste and disposition as to expenditure of the consumer. It is the knowledge of the performance and characteristics of the ubuquitous motor translated into useful applications and interpreted in dollars and cents. It is the perception of more sanitary surroundings, improved hygienic conditions, raised standards of morality and loyalty upon the part of employees through the benefits of applied electricity. It is making two blades thrive where but one struggled before. It is helping to do the work of the world more economically, more rapidly, more cleanly than ever before.

H. J. Gille,
Chairman, Commercial Section, National Electric Light Association.

The Lakes to the Gulf Deep Waterway.

At the regular meeting of the Electric Club of Chicago, held at the Kuntz-Remmler Restaurant, January 3, Isham Randolph gave an interesting talk regarding the contemplated deep waterway to extend from the Great Lakes to the Gulf of Mexico. Mr. Randolph has been interested in waterway propositions for the past twenty years and is very well known in connection with that work.

As explained by the speaker the ultimate object of such a canal is not direct competition with the railways, but is rather as an auxiliary, and a supplement to railway facilities. Obviously it was impossible for the old shallow canals to offer service to shippers which would compete with that given by the railway lines. They gradually lost usefulness even as supplements to overland systems.

He called especial attention to the size of the Mississippi valley and the traffic that would necessarily result on a properly constructed canal. The valley can, he holds, support as large a population as does Great Britain.

The position of hydroelectric plants in the canal scheme was touched upon slightly, although Mr. Randolph asserted this would be an important feature, and would provide a not inconsiderable income for the project. That the work will be carried out at some future time is highly probable, and the delays and disappointments met with up to the present time have not in any way dimmed the enthusiasm of those intimately interested in the venture and bent upon its completion.

Guy E. Tripp Elected Chairman Westinghouse Directors.

Guy E. Tripp was elected chairman of the board of directors of the Westinghouse Electric & Manufacturing Company at the board meeting on Wednesday, January 10, succeeding the late Robert Mather. Mr. Tripp is connected in an official capacity with a number of public service corporations. He is president of the Dallas Electric Corporation, El Paso, Galveston, Houston & Northern Texas electric companies, Northern Texas Traction Company, Pacific Coast Power Company, Whatcom County Railway & Light Company; he is vice-president of the Stone & Webster Management Association, of Boston, Paducah Light & Power Company, Paducah Traction Company, Puget Sound Electric Railway, Puget Sound International Railway & Power Company, Seattle Electric Company, Tacoma Railway & Power Company; and director of the Stone & Webster Engineering Corporation, Galveston-Houston Electric Company, Houghton County Street Railway Company, Paducah Traction & Light Company, St. Croix Falls, Minnesota Improvement Company, Pacific Coast Power Company, Electric Light & Power Company of Abington and Rockland.

The Chicago Section of Electrochemical Society Meets.

A meeting of the Chicago Section of the American Electrochemical Society was held on the evening of January 5 in the rooms of the Western Society of Engineers. An election of officers was held which resulted in the choice of Leland L. Summers as president and Arba B. Marvin as secretary, the latter being re-elected.

The subject for discussion for the evening was "The Fixation of Atmospheric Nitrogen." The general discussion on this subject was led by L. L. Summers and E. R. Wolcott. The remarks of the latter were in substance as follows:

Although the fixation of nitrogen is usually considered one of the modern problems of electrochemistry, it is in fact one of the very first discoveries of that branch of science, antedating the electrolysis of water and the discovery of the alkali metals. However, only within the past decade has any progress been made in the commercial solution of the problem. Aside from the indirect methods of fixing nitrogen, such as separating the oxygen as found in the air and combining it with calcium carbide to form calcium cyanamide, many processes have been proposed for the direct combination of the nitrogen and oxygen. This can be done by purely thermal means, as well as by means of the silent electric discharge and various forms of sparks and arcs. At first difficulties arose in getting continuous and satisfactory operation of these arcs, and then it was necessary to find suitable electrodes and furnace linings as well as the proper methods for oxidizing the nitric oxide to the peroxide and absorbing it. At the present time, however, the problem is simply a question of efficiency. What method will give the highest yield?

In Europe, and in Norway in particular, the problem is quite different from what it is in this country. In Norway, for instance, hydroelectric power can be developed for $30 a kilowatt and can be bought for less than $8 a kilowatt-year. Thus a process which is commercial in that country may be far from it in this country, where it is difficult to obtain power for twice or even three times that amount. With an efficiency of 90 grams of commercial acid per kilowatt-hour (which is about what they obtain in Norway), that is, one-fifth of a pound, at five cents a pound, the gross receipts would be only one cent per kilowatt-hour. Fortunately there are opportunities for increasing the efficiency, since only about one-tenth of the energy now applied is actually necessary to bring about the reaction. It is also possible that waste heat may be utilized to a certain extent to preheat the air and thus bring about higher temperatures, which are accompanied by the production of a higher percentage of fixed nitrogen.

Lamp Manufacturers Granted Modifying Decree and Extension of Time.

Judge John Killits, United States District Judge of the Northern District of Ohio, has signed a modifying decree giving to the General Electric Company, the National Electric Lamp Company and the other lamp companies, three months' extension of time to reorganize their affairs. The first ninety days granted the companies to reorganize expired on January 12. When signing the order for this three months' extension, Judge Killits also granted a stay of the injunction obtained October 12, by the Government, which injunction provided that the companies should not continue to do business after January 12 until they reorganized under penalty of being in contempt of court. The purport and intention of the modifying decree is to give the companies until April 12 to reorganize. Owing to the great amount of work involved, notwithstanding the earnest efforts of the attorneys for both sides, it was found impossible to get things into proper shape and the Government's attorneys and the Judge decided that it was only common justice to the companies to extend the time.

The Byllesby Convention.

The largest and most successful convention ever held by H. M. Byllesby & Company, and affiliated companies, was concluded on January 5, with a banquet in the Gold Room of the Congress Hotel, Chicago, over 400 guests being in attendance. Addresses were made by Samuel Insull, George M. Reynolds, Governor Eberhart, of Minnesota; C. A. Coffin, president of the General Electric Company, Charles G. Dawes and the Rev. Herman Page. Mr. Insull spoke for Mr. Edison, and it was with a peculiarly happy expression he began his remarks. Just before rising Mr. Edison had prepared this message to the young men of the Byllesby organization: "When you get a job, pitch into your work and pay no attention to the clock or to time, think of nothing, talk of nothing but shop, and when the boss comes around pay no attention to him but to your work, and, my word for it, when you want to leave for some other job the 'old man' won't let you go, but will likely take you in as a partner."

During the week formal sessions were held morning and afternoon. On Tuesday, Wednesday, Thursday and Friday papers were presented by members of the organization, and on Friday afternoon the convention was addressed by T. C. Martin, secretary of the National Electric Light Association. On Wednesday evening a reception was tendered by Mr. and Mrs. Byllesby at their home on Drexel Boulevard.

Power Requirements in Paper-Box Factories.

A Study of the Advantages of Electric Drive—Types of Motors for this Service—Speed Control—Power Data of Modern Factories.

While the use of the electric motor in driving machinery for making paper or cardboard boxes cannot be said to be new, it appears that this particular application of the motor has by no means become so general as its fitness for the service and the profitableness to the central station of the box-factory load would warrant. Except for a short evening interval during the winter months the box-factory load is always off-peak service. Moreover, although the power required for driving any one machine in a plant of this sort is relatively small, the motor sizes required varying largely between the limits of one-quarter and fifteen horsepower, the aggregate demand for power is sufficiently large, even in the case of a small plant, to be attractive to the central station. The actual possibilities of this class of service, however, may be better understood from a brief consideration of the installation found in the average type of paper-box factory.

Fig. 1.—Printing Department, Battle Creek Paper Company.

So far as their manufacture is concerned, paper or card-board boxes may be divided into three general classes. These are the so-called "folding" box, what is known as the "set-up" box, and finally the shipping container. The folding box, it may be explained, is thus styled on account of the fact that it may be shipped in the folded or flattened condition; while the set-up box is shipped usually in the shape it has when in use. Shipping containers are made either of a fiber board or of corrugated cardboard.

While practically every process employed in the manufacture of either one of the three boxes just mentioned is accomplished by means of some machine or other, and the number of machines in any plant whose business is at all considerable is therefore great, it is not a very difficult matter to get a working idea of the essential features of the principal machines to be found in operation in a typical factory. An exception to this statement is necessary, perhaps, in the case of plants making shipping containers, this last being a comparatively new business. Standard machines for making boxes of this kind are not yet on the market. The manufacturers design their own machinery, and most of them object seriously to the publication of any matter descriptive of the appliances they use. Passing to the consideration of the machines employed in making boxes of the other two types, it is to be noted that practically the same procedure is followed in making boxes of both the set-up and the folding variety. Printing the cardboards or the paper cover, as the case may be, may be considered the first step of the process. A large percentage of the smaller boxes have to be printed on from one to four sides and in from one to three colors. Thus it happens that one finds in many of the larger plants a rather unusual assortment of high-class printing equipment. Fig. 1, for example, is a photograph of a printing room of a modern paper-box factory. This picture, it may be remarked in passing, is itself a strong argument in favor of motor drive for work of this character. There are fourteen printing presses here and each one of them is driven by its own individual motor. Moreover each of the larger presses is equipped with a Dexter automatic feeder, driven by a seven-eighths horsepower motor. This feeder, the use of which insures a maximum of efficiency of operation for the press, is adapted especially for motor drive. For cleanliness and good daylight illumination the room shown in the illustration is quite remarkable.

What is really the first step in the actual making of the box itself consists in cutting the cardboard to the desired size and scoring it in the lines along which the board must later be bent. There are two principal types of machines for performing this operation, one of which is shown in Fig. 4, and the other in Fig. 9. In machines of the first type the cardboard is placed on a moving horizontal table, which carries it under revolving circular knives, and these latter do the necessary cutting and scoring. The other type of cutting and scoring machine is very similar to a printing press. The knives are set up in a form very much as type is arranged in printing, and the cardboard placed on this. The form then either passes under a revolving cylinder or else the necessary pressure is applied as in the case of an ordinary job printing press. With either class of cutting and scoring machine, adjustable-speed drive is absolutely essential in order to secure the highest possible operating efficiency. Moreover the greater the number of speeds possible—within reasonable limits, of course—and the more readily the speed adjustment may be made, the higher the efficiency of operation. When the feed is automatic the best speed will depend upon the quality of the stock being cut and scored, while in the case of the hand-fed machine, the skill of the operator

must also be taken into account in determining the proper speed.

After the cutting and scoring, the corners of the cardboard are cut away, and Fig. 2 is a photograph of the machine generally used for this further process. Here, too, it is desirable to be able to vary the speed of the machine at will between wide limits.

The box next goes to the gluing or staying machine, which appliance brings the edges of the cardboard together where corners are to be made, and glues a narrow strip of paper or thin cloth over the corner along its length. This entire process is automatic, and here again adjustable-speed drive is essential to high efficiency of operation. If the speed of the machine be kept at the value adapted to gluing or staying small boxes made of a good quality of cardboard, the spoilage is liable to be very great on a run of the larger boxes, or on those made of a lower grade of stock.

Other machines found in almost any box-making plant include slitters for cutting into the proper widths the paper needed for staying corners and for covering boxes made of unfinished board; also machines for applying this paper to boxes of the class just mentioned, and machines for stitching with metal rivets certain boxes where it is not desirable to glue the corners together. Some of these machines are also shown in the accompanying photographs.

Advantages of Motor Drive.

The necessity of provision for flexibility of speed adjustment in driving box-making apparatus has already been referred to. While the speed of a shaft-driven machine may be varied within certain limits by means of cone pulleys, such an arrangement does not compare at all favorably in efficiency and convenience with the speed adjustment to be had with the proper type of electric motor. In one of the plants visited in collecting material for this article, where shaft drive is employed, it was found that in one instance cone pulleys had been installed for the purpose of speed control. But it happened that the driven machine, a quadruplex stayer, could not be run very well from an overhead line shaft. So the drive was operated by means of a belt passing upward from a shaft on the ceiling of the room below, and this made it necessary for the lever used in changing the speed to be installed in the lower room. It is probable that by using an electric motor equipped with the right kind of controller for driving this stayer, the saving which might be effected in one year's operation would more than equal the cost of both motor and controller. In this connection the installation of which Fig. 5 is a photograph is particularly interesting. The central station supplies only alternating-current service in the district where this plant is located. But the manager of the factory, conscious of the economy of flexibility of speed adjustment in the operation of box-making machinery, installed the motor-generator set, shown in the illustration, and now uses a direct-current motor equipped with a Cutler-Hammer controller on practically every machine in the factory.

Fig. 2.—Corner-Cutting Machine.

Another very important advantage of motor drive—particularly of individual motor drive—in the paper-box factory, is that it promotes cleanliness in the room. While cleanliness may be more or less desirable in any sort of workshop, it is absolutely necessary that the paper-box factory keep its products free of dirt and oil and dust. If the boxes are not turned out clean and fresh looking, there is little or no market for them.

The foregoing remarks concerning the necessity of cleanliness in box factories apply with equal force in the consideration of the illumination of plants of this kind. Aside from all considerations of the desirability of well lighted, cheerful surroundings for operators, it should be noted that ample and rather general illumination in most of the rooms of a paper-box factory is indispensable to the production of high-grade boxes. An approach to an illumination of anything like a uniform intensity is quite difficult and may be indeed impossible in rooms where there are many line shafts and long belts.

Passing now to the question of losses in belts and friction losses in line-shaft bearings, it may be remarked that it is a rather difficult matter to obtain numerical data on this subject. The best information available, though, seems to justify the assertion that where engine drive is employed in a box factory the loss of power between the engine flywheel and the driven machinery is at least fifty per cent. A consideration of these losses, however, naturally brings up the subject of the relative advantages of individual and group drive in plants using electric motors for the operation of machines.

Fig. 3.—Universal Covering Machine.

Individual Versus Group Drive.

Aside from the question of friction losses, the remarks just made concerning the necessity of cleanliness and good lighting in the box factory constitute a strong argument in favor of individual drive. In discussing this

subject, though, the managers of box-making plants sometimes advance the contention that since the power required by one of the box-making machines is relatively small, group drive is to be preferred where electric motors are employed. At first thought this argument would appear rather plausible, but upon further consideration it loses much of its force. Box-making is distinctly a "make-to-order" business. The storage room for one dollar's worth of goods is larger in the case of paper boxes than in that of almost any other manufactured product, and hence the factory is obliged to adjust its weekly output to the demands of current sales conditions. Thus, it may happen that several of the machines belted to a single line shaft will be idle rather frequently. When this is the case, of course, the ratio of energy delivered to this particular shaft to that employed in the operation of machines is abnormally large. Moreover, the additional room made available by the absence of shafting and the practical absence of belts as well, where individual drive is employed is, as has just been suggested, an asset of no inconsiderable value. What the box maker has sometimes considered a further obstacle in the way of group drive is the frequent necessity of a rather large speed reduction between the motor and the driven machine. However, where individual drive has been installed this seeming obstacle has proved to be no obstacle at all. It is found that entirely satisfactory service may be obtained by installing the motor drive either on a bracket on the driven machine or on the floor under it, and using a short belt for the drive. An idler or belt tightener is made use of, this being a small affair attached either to the motor frame or to the frame of the driven machine. These idlers are practically noiseless and take up no room that could be put to any other useful purpose. A further advantage of individual drive which though not so important as some of the foregoing, is well worth taking into account, arises from the fact that where this system is adopted it is comparatively easy to move the smaller machines from one part of the factory to another and thus adjust their location to any possible changes in conditions in the room or in the plant. Fig. 4 is a photograph of a cutting and scoring machine of such a design that it may be moved around without difficulty.

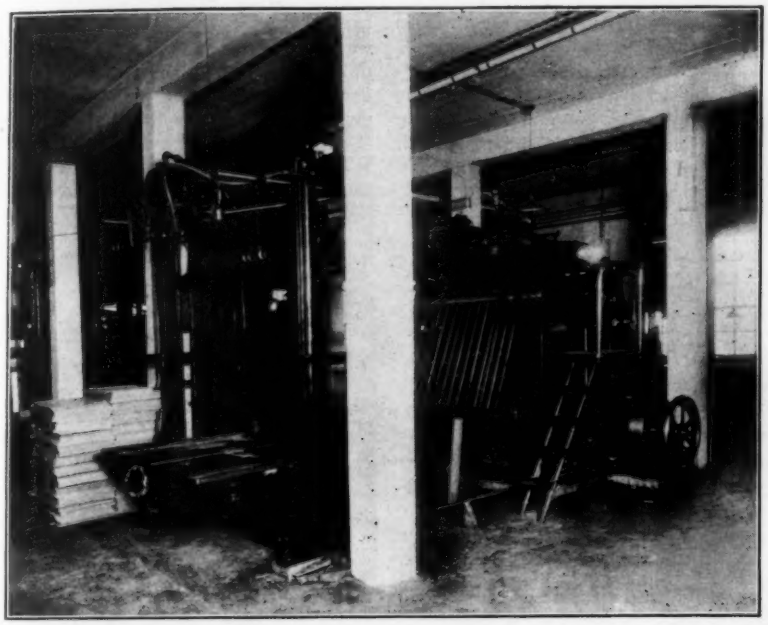


Fig. 4.—Cutting and Scoring Press.

The earlier box-making plants to adopt electric drive generally installed group drive, the motors being placed usually on horizontal platforms attached to the ceiling. In later installations, however, the use of a motor for each machine to be driven is the commoner practice. While the power consumption per month of a given factory might even be less with individual drive than it would be if any other type of drive were employed, the service will always prove so much more popular that it would seem best for central station managers and solicitors to encourage as far as possible the adoption of drives of the former type.

Fig. 5.—Power Room, Battle Creek Paper Company.

Fig. 6.—Wire-Stitching Room.

Lighting.

The illumination in the average box

factory appears to be rather remarkable as a rule for its crudeness and lack of real efficiency. In one of a dozen or so plants recently visited, the lighting was found to be done by means of gas arcs, although the plant was using electric-motor drive exclusively. The manager explained that when he had formerly used electric lamps every operator in the shop thought she must have a drop light over the machine she was running, and that rather than go to the expense of supplying these he had decided to substitute gas.

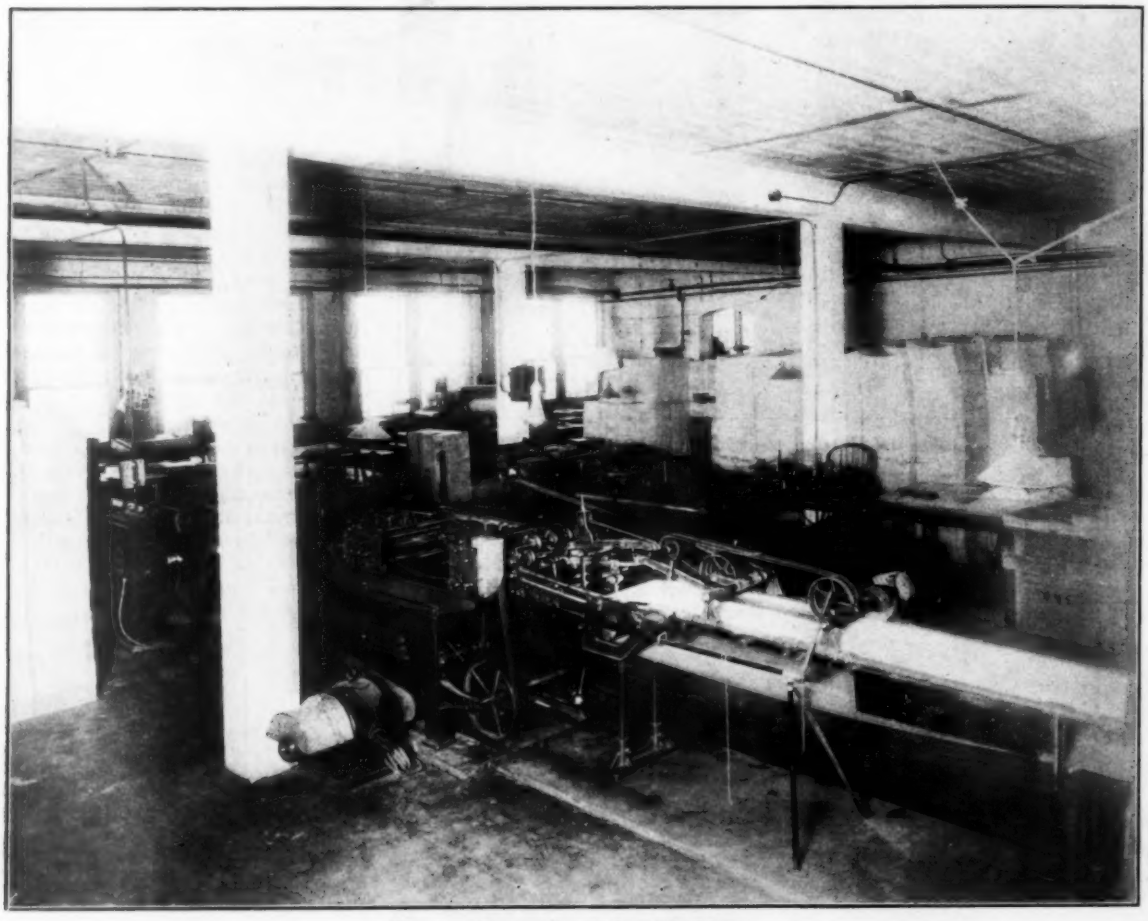


Fig. 7.—Automatic Gluing Machines.

The plant was admirably adapted for lighting by means of tungsten clusters in steel reflectors. Either these tungsten groups or 150-watt single-lamp units may be used to great advantage in the lighting of almost any box factory. In many of the rooms good, efficient lighting can be obtained by placing one of these units over each machine, thus providing an illumination which is both localized and at the same time sufficiently general for all practical purposes. There should also be provisions for extension lights around large machines, such as the larger cutting and scoring presses, these lights often being very necessary in making repairs or examinations within or under the machine or some part of it. A very satisfactory arrangement may be obtained by installing receptacles for extension lights on the machine itself, the circuits for these being run up from the floor in flexible steel conduit.

Heating.

In one of the plants mentioned in the foregoing discussion, the heating was accomplished by means of air circulated over steam coils. A return tubular boiler operated at ten to fifteen pounds pressure is employed for producing the necessary steam and an induction motor drives the fans which keep the air in circulation. After several years of motor drive and this system of heating, the manager stated that he has no misgivings whatsoever as to the present arrangement being more economical than an isolated plant for both heat and power. Another large, modern box factory buys live steam for heating, this steam being piped a distance of approximately 1,000 feet.

It is interesting to note in passing that the factory last mentioned also buys steam to drive pumps which supply the plant with all water used, the water being obtained from a deep well on the company's premises. The manager states that he is able to realize a great saving in this way over what his water bills would be if he bought water from the street mains. It is obvious that electric motors would render admirable service in driving these pumps, and with motor-driven pumps it might be possible to do the pumping at the time best suited to the convenience of the central-station load. There are doubtless many industrial plants which could afford to adopt electric pumping from their own wells and which would be glad to give the matter proper consideration if their attention were called to it by the central-station manager or his representatives.

In connection with heating, some remarks concerning glue heaters would seem to be appropriate. The modern electric glue heater is certainly well adapted to box-factory service; but many plants are either employing

Paper Box Factory Data—Sheet No. 1.

This factory, the name and location of which are withheld by request, is engaged in the manufacture of paper boxes and booklets. Individual drive. Running hours per week, 55.

Total connected horsepower, 167; total number of motors installed, 63; average kilowatt-hours per month 10,043.

Kilowatt-hours per month for six months (1911): January, 8,840; February, 9,150; March, 13,280; April, 14,490; May, 1,030; June, 13,470.

MOTOR INSTALLATION.

The following includes a list of the motors installed, with their respective drives. All motors use direct current and operate at 220 volts.

No.	Horse-power	Speed R. P. M.	Application
3	5	975	Compound-wound motors, each belted to a Cottrell drum-cylinder cutting and creasing press. Sixty-four-inch cylinders, and Dexter Automatic feed. Maximum capacity of each press 1,500 sheets an hour.
1	5	900	Compound-wound motor, belted to a sixty-inch drum-cylinder cutting and creasing press.
1	5	1,050	Compound-wound motor; drives a thirty-eight-inch Colts-Armory cutting and creasing press.
6	3	530	Compound-wound motors, each driving a forty-two-inch Adams cutting and creasing press. Capacity of each press, 900 sheets an hour.
2	2	1,200	Compound-wound motors, each driving a forty-inch Universal cutting and creasing press. Capacity of either press, 1,500 sheets an hour.
3	0.75	700	Compound-wound motors, each driving a fourteen by twenty-two-inch Universal hand-feed cutting and creasing press.
3	5	975	Compound-wound motors, each driving a Staude automatic gluing machine.
1	5	975	Compound-wound motor, driving a La Bombarde gluing machine.
1	2	1,200	Shunt-wound motor, driving shaft, to which six Wilson hand-gluing machines are belted.
3	1	850	Compound-wound motors, each driving a Dexter automatic feeder and folder.
2	0.33	700	Compound-wound motors, each belted to a hand-folder.
14	0.125	970	Shunt-wound motors, each geared to an automatic wire stitcher.
2	3.5	1,000	Compound-wound motors, each belted to a fifty-four-inch Seybold paper knife.
1	2	1,200	Compound-wound motor, geared to a thirty-six-inch Seybold paper knife.
2	2	1,200	Compound-wound motors, each belted to a forty-four-inch Dexter and Seybold paper knife.
1	3	1,600	Shunt-wound motor, belted to sharpener for grinding paper knives.
3	10	730	Compound-wound motors, each belted to a two-color sixty-five-inch Miehle drum-cylinder printing press.
1	10	785	Compound-wound motor, belted to a fifty-four-inch, two-color Huber printing press.
3	6	870	Compound-wound motors, each belted to a Miehle, sixty-eight-inch, single-color printing press.
1	3.5	1,050	Compound-wound motor, belted to a Harris automatic printing machine.
3	5	975	Compound-wound motors, each belted to a sixty-two-inch Campbell printing press.
2	0.6	700	Shunt-wound motors, each belted to a Colts-Armory job printing press.
1	1	700	Shunt-wound motor, belted to a Colts-Armory job printing press.
1	0.75	700	Shunt-wound motor, belted to a Chandler and Price job printing press.
1	0.25	1,000	Shunt-wound motor, driving a Lanston monotype keyboard.
1	3	880	Shunt-wound motor, belted to air compressor.

The manager of this plant is particularly enthusiastic over central-station service and individual drive. He buys steam for heating his plant from a neighboring factory.

The Fisher Paper Box Company, Minneapolis, Minn., does a general box-factory business. Individual drive. Running hours, per week, 54.

Total connected horsepower, 22; total number of motors installed, 29; average kilowatt-hours per month, 616; average kilowatt-hours per connected horsepower, 29; load factor, 14 per cent.

Kilowatt-hours consumption for 12 months (1910-11): November, 766; December, 657; January, 703; February, 508; March, 545; April, 658; May, 577; June, 542; July, 555; August, 642; September, 618; October, 616.

No.	Horsepower	Application
1	1.5	Belted to double-scorer and corner cutter.
1	2	Belted to shaft driving lathe, drill and grinder.
1	2	Belted to paper cutter.
1	0.125	Belted to circle cutter.
1	0.75	Belted to a sixty-inch single scorer.
1	0.25	Geared to a wire stitcher.
1	0.5	Geared to a flyleaf machine.
1	0.2	Belted to an emery grinder.
1	0.16	Belted to an automatic staying machine.
1	0.75	Belted to an automatic ending machine.
1	0.2	Geared to an automatic labeling machine.
1	0.75	Belted to paper slitter.
1	1	Belted to an automatic flange bender.
1	.1	Geared to a wire stitcher.
1	0.25	Belted to Gordon job printing press.
1	0.5	Belted to a Colts-Armory printing press.
1	2	Belted to a circular saw.
1	5	Used in driving elevator.
1	0.4	Belted to a creasing machine.
1	0.4	Belted to a lock-corner cutter.
1	0.125	Belted to staying machine.
1	0.5	Belted to nailing machine.
1	0.5	Belted to a double-corner cutter.
1	0.2	Belted to staying machine.
1	0.2	Belted to gluing machine.
1	1	Belted to wrapping machine.

Paper Box Factory Data—Sheet No. 2.

Illinois Paper Box Company, Chicago, Ill. Does a general box-making business. Drive, both individual and group. Running hours, per week, 59.

Total connected horsepower, 21; number of motors installed, 14; average kilowatt-hours, per month, 1,000.

Kilowatt-hours consumption for twelve months (1911): January, 960; February, 1,040; March, 850; April, 790; May, 780; June, 840; July, 1,100; August, 730; September, 920; October, 1,030; November, 1,090; December, 1,030.

MOTOR INSTALLATION

The motors in this plant are 220-volt machines, both compound-wound and shunt motors being used.

No.	Horse-power	Speed R. P. M.	Application
1	3	950	Belted to Colt's press.
1	0.5	600	Drives Universal press.
1	0.5	450	Belted to Gordon Pony press.
1	3	950	Shunt-wound machine, driving shaft to which are belted three 45-inch single scoring machines, one double scoring machine, a double corner cutter, a single corner cutter and a 5½-inch slotter.
1	2	975	Belted to a 33-inch Sheridan cutter.
1	2	1,200	Shunt-wound motor, drives one No. 10 stayer, one label cutter and one National ender.
1	3	950	Shunt-wound motor, drives three 13-inch, one 11-inch and one 17-inch covering machines; also three 14-inch Knowlton stayers and one Latham stitcher.
1	3	950	Shunt-wound motor, drives three 10-inch covering machines, one 3-inch stayer and one Stokes-Smith wrapper and stenciler.
1	0.25	820	Drives Stokes-Smith gluer.
1	0.25	400	Drives a No. 7 Knowlton and Beach staying machine.
1	0.75	1,300	Geared to a Stokes-Smith lacer.
1	0.75	1,700	Geared to a 14-inch wrapping machine.
1	1.25	1,000	Drives a Stokes-Smith wrapping machine.
1	0.50	975	Belted to a 30-inch Wilson wrapper.

The manager of this plant considers the electric motor the only satisfactory drive for box-making machinery. He is also enthusiastic about central-station service.

Plant is located at Dunkirk, N. Y.; name withheld by request. Manufactures paper boxes exclusively. Both group and individual drive is employed. Running hours, per week, 60.

Total connected horsepower, 23; total number of motors installed, 10; average kilowatt-hours, per month, 324; average kilowatt-hours, per month, per connected horsepower, 37.

MOTOR INSTALLATION

This installation consists of both shunt and compound-wound, direct-current, 220-volt motors.

No.	Horse-power	Speed R. P. M.	Application
1	1	1,200	Compound-wound motor, belted to fourteen by twenty-two-inch Colts-Armory printing press.
1	1	850	Compound-wound motor, belted to twenty-six by forty-inch Babcock cylinder press.
2	0.25	1,900	Compound-wound motors, each belted to an eight by thirteen-inch job printing press.
1	1	1,700	Shunt-wound motor driving shaft to which are belted a forty-five-inch scoring machine; a Knowlton corner cutter and a twenty-eight-inch Hobbs slitter.
1	2	1,900	Shunt-wound motor, belted to a shaft from which are driven a Parry wrapping cuter and a ten-inch circular saw.
1	1	1,900	Shunt-wound motor, belted to shaft from which a No. 5 and a No. 7 Knowlton stayer are operated.
1	1	1,275	Compound-wound motor, belted to shaft, which drives a Style A, Stokes-Smith wrapper and an eighteen-inch gummer.
1	1	1,700	Shunt-wound motor, belted to shaft, which drives three Knowlton stripping machines.
1	0.25	1,900	Compound-wound motor, belted to sixteen-inch Knowlton gummer.

Michigan Carton Company, Battle Creek, Mich. Engaged in making paper boxes. Individual drive. Running hours, per week, 56.

Total connected horsepower, 140; number of motors installed, 24.

MOTOR INSTALLATION

Compound-wound, 220-volt motors are used throughout the plant.

No.	Horse-power	Speed R. P. M.	Application
2	15	825	Each belted to a Huber forty-two by sixty-two-inch two-color printing press.
1	12	875	Belted to a forty-six by sixty-five-inch two-color Miehle printing press.
2	5	800	Each belted to a forty-five by sixty-two-inch two-color Huber press.
4	5	1,050	Each belted to a forty-four by sixty-two-inch Miehle single-color press.
2	3	900	Each belted to a thirty-six by fifty-three-inch single-color Miehle press.
4	5	825	Each belted to a forty-four by sixty-four-inch Cottrell cutting and scoring machine.
5	3.5	825	Each driving a twenty-nine by forty-two-inch Adams cutting and scoring machine.
3	5	1,025	Each driving a Staude automatic gluing machine.
1	5	1,025	Belted to an International gluing machine.
1	5	825	Belted to a fifty-four-inch Seybold cutter.

both electric and steam or gas heaters, or else using gas and steam altogether, for heating glue.

It must be frankly admitted that in many cases the heating of glue pots by electric current has not been satisfactory, and factories using them have in some cases replaced electric heating by steam or gas heating. The principal objections have been that the electric heaters have failed through burnouts or similar troubles, and that too much time has been required to heat up in the morning, thus delaying the work. This is much to be deplored, since both of these objections can be obviated by a suitable installation, including the use of a time switch for starting up in the morning. This subject will be more fully discussed in an article in next week's issue on the use of electric power in a furniture factory.

Wiring.

The wiring requirements in a paper-box factory are simplified in a measure by the absence there of extremes of temperature and moisture. Open conduit construction is to be preferred for .erhead circuits usually. In addition to being permanent, safe and of good appearance this type of wiring construction lends itself most readily to any interchange of outlets which may become necessary by the location of machines or stock being altered. When open conduit work is employed there should be provision in all principal junction boxes for the addition of new circuits whenever these become necessary. In one of the factories, of which portions are shown in some of the accompanying cuts, the wiring is in many ways ideal. As the photographs indicate, all lighting circuits are run in open conduit on the ceiling. The motor circuits, however, are run in conduit installed under the floor. Thus there are no vertical wires depending from the ceiling in any part of any room. Wherever a motor starting-box cannot be attached to the driven machine it is fastened by means of cleats to a vertical piece of gas pipe of the proper height to bring the box within convenient reach of the machine operator, the gas pipe being fastened to the floor at the bottom by means of an ordinary floor flange.

When open knob or cleat wiring is employed in a box factory care should be taken to protect all circuits on side walls properly and also those on the ceilings of the store rooms where stock is liable to be piled against the wires. Whatever type of wiring is employed, all switches controlling branch circuits should be grouped in steel switch cabinets.

Best Type of Motor.

In paper-box factories of the usual kind compound-wound, direct-current motors are employed mainly if individual drive is used. These should generally be of the enclosed or semi-enclosed type, there being at least sufficient protection for the commutator from the possible throwing or accidental dropping of foreign objects upon it. Where standard open-type motors are used they are sometimes enclosed in a box made of three-quarter-inch board, the box being arranged so as to protect not only the motor but a large part of the belt as well, and also in such a way that it may be easily opened for inspecting the motor. The commonest voltage is 220 and the maximum speeds of the motors generally lie between 750 and 1,100 revolutions per minute. If group drive be employed the shunt motor seems to be satisfactory. In this latter case induction motors may be used, of course. A certain plant engaged in manufacturing large shipping containers uses the two-phase induction motor altogether. The motor requirements, however, are stated more specifically in the data sheets which are found on preceding pages.

Fig. 8.—Folding Department, Paper Box Factory.

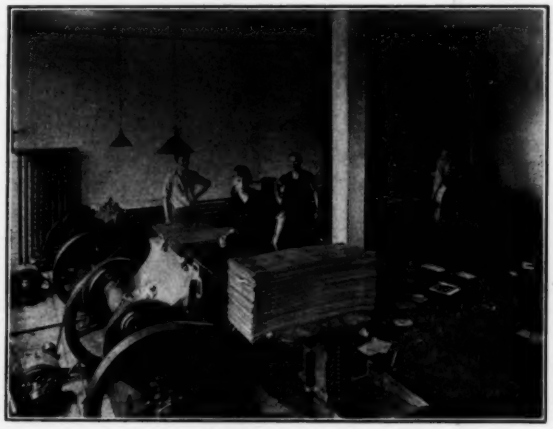


Fig. 9.—Cutting and Creasing Presses.

Telephone Rates in Detroit.

An ordinance has been introduced in the City Council of Detroit for revising the telephone rates in that city with the view of equalizing rates among different classes of users. The bill has been framed by Corporation Counsel Hally after long study.

Hally has constructed the ordinance on the theory that under the present ratings of the telephone companies the infrequent users of telephone service are paying much more than they should and that the heavy users, or business houses, are paying less than they should—in other words, that the residence telephones are carrying the expense of the business telephones.

The striking feature of the new schedule is that it limits the number of outgoing messages that may be sent over all classes of telephones and fixes a uniform charge of one cent a message for all that are sent in excess of the limit. The number of incoming messages is not taken into consideration.

There are only three leading classes of service in the new schedule, individual, two-party and four-party lines. There is no distinction made as to residence or business purposes.

The rate for single-party lines for whatever purpose is $39.60 a year, as against $72 a year now charged by the Michigan Telephone company for business telephones. The number of outgoing messages allowed to be sent free on the payment of this rate is limited to 200 a month.

The rate for a two-party line is $21.60 a year, as against the rate of $60 now charged by the Michigan company and the number of free messages under this classification is limited to 100 a month.

The rate for all four-party lines is $12 a year, as against the $24 rate now charged by the Michigan company and the limit of free messages is 50.

Commercial Practice
Management, Rates, New Business

POINTS OF CONTACT WITH THE PUBLIC.

By William H. Hodge.

An Address, by the Publicity Manager, Before the Third Annual Convention of the H. M. Byllesby Companies, Chicago, January 3-5, 1912.

The subject of desirable relations between utility companies and the public has been given much attention during the last few years. There have been overloads of preaching and advice and it would seem that the extraordinary quantity of good counsel must long ago have had its effect, the reforms adopted and an era of peace begun.

But the new order does not come about as swiftly as the logic of the situation would bid.

Public utilities exist for the purpose of contact with the public. In modern town life they enter into the lives of nearly every individual every day out of the 365. Their work is a series of constant contacts with the public.

Public utilities in reality are the most democratic of commercial institutions. Patrons are of all conditions and of all classes in the human scale. They are served with more uniformity and less discrimination by gas, street railway, electric, telephone and water companies than by any other business.

The widowed washer-woman is supplied with gas of the same heating value as that delivered the wife of the banker who employs her and who pays at the same rate; electricity of equal voltage and price is delivered to mansion and cottage; all fares look alike to the street car conductor; the telephone operator responds with equal celerity to the voice of the clergyman or the bartender.

Although the facts are as stated it is equally true that popular conception of public utility corporations is that they are anything but democratic. This state of mind on the part of the public is due to two reasons; first, because of the monopoly feature in response to the economic law that municipal utilities are best and most economically conducted as monopolies, and second, because the true democracy of utility companies has not been suitably expressed in the acts and words of the operating organizations.

The experience of the Byllesby operating companies has proven perhaps as conclusively as can be proven, that wherever the public is treated fairly in all things relating to the company's activities, and where proper care has been taken to be courteous as well as fair; to enter into the commercial and social life of the community as a beneficial force and properly to enlighten the people of these policies and facts, the public in return has treated the corporations fairly and generously and bestowed its friendly approval.

Contact with the public in utility operation is the day's work; it is the ensence of the business—the thing that must be whatever else may not.

The organization that regards its destiny of public contact as a misfortune or a nuisance misunderstands its work. It has a feeble grip on life. It easily can be made the football of its enemies and adverse legislation. It is looking for trouble and certainly will find trouble.

The public has just as much right to expect courteous, prompt and pleasant attention from the officers and employes of a company as it has the right to expect good service in exchange for its cash and the monopoly privileges conferred. An employee who is polite to customers or prospective customers, merely is doing his duty and performing an act which is expected of him and for which he is paid. Courtesy to the public neither is condescension towards the customer nor giving the company more than its due. It is no special virtue for either corporation or employe.

To the public there are two distinct phases or utility corporation contact—personal and impersonal. The impersonal contact, of course, is with the service rendered. The customer has to stop and think before he remembers that there is a group of peronsalities creating the service and if the service is continously good he may never think of it at all.

The personal phase of a corporation's contact with the public lies in the officers who represent it in the eyes of the people; the salesmen who seek their patronage; the cashiers and clerks who accept their money; the employes who correct trouble and who handle complaints; the motormen and conductors on the cars; the telephone operators; the men who read the meters and occasionally the linemen and other workmen.

Now, a house fuse may blow out but it cannot answer back. A gas pipe can be plugged with naphthalene, but it is never in a hurry or peevish. A street car may be overcrowded or late but it cannot become involved with obnoxious political functions. A telephone transmitter may refuse to work, but it has no power to order people around or to dispute bills.

The kind of service a man receives is secondary to the kind of treatment his pride receives. If he believes the company treats him with respect and fairness, he is willing to put up with a certain amount of interruption to the service and not grow hostile. But if he bears a grudge against the company the best service and the lowest rates will not make him a friend.

Utility companies derive the right to do business from the people, and they are, therefore, subject to the will of the people. Regardless of the precise character of the political machinery in vogue, every utility company in the United States relies for its stability upon the sufferance of the public.

From time to time all companies must meet questions regarding their franchise rights, rates, extensions, improvements, character of service, etc. Sometimes the question is decided by a commission or city council; sometimes by a court and not infrequently by the people themselves at a popular election. In the final settlement of all of these issues the standing of the company with the people is the predominating factor. The fate of the real points involved in the controversy depends greatly upon the feeling of th public for or against the corporation.

The Byllesby companies, under the direction and example of Vice President Arthur S. Huey, have tried to make it plain that our wish to be courteous is based on something deeper than the axiom that "a smile turneth away wrath." We have tried on every possible occasion to show that we realized our obligations and the exacting character of our work, and were doing our best to live up to these realizations. We have tried to impress upon the public that we regard our

work in the nature of a public trust; that we ask payment only for what we earn and that we desire neither compensation nor consideration except in exchange for value given.

Also, we have insisted publicly that a utility company is a very important factor in municipal development, and that a company which bears progressively and energetically its share of the collective toil, investment and effort necessary to make a city is entitled to credit therefor and the material profit resulting.

Mr. Huey in repeated public addresses, and in personal advice to managers, instead of dilating upon the matter of mere courtesy as such, has directed attention to the underlying reasons for courtesy and fair treatment of the public, believing that where the officers and employes have the right spirit in their work a habit of cheerful courtesy naturally will follow.

In setting a high standard for dealing with the public, our officers have made it plain that they do not expect their representatives to assume a grovelling attitude, nor to appear to scrape favor at the expense of self-respect. There is neither necessity nor occasion for seeking the influence of individuals by fawning and flattery. Self-respect and friendly methods at the Byllesby properties are fast friends and get along well together. Our claims for public good will consist of enduring material not affected by every wind that blows.

All important in the matter of friendly public relations at local properties is the manager. His personality in a large measure must stand for the personality of the organization. He is called upon to mingle with the leaders of thought and action in his community and he is compelled to express himself upon many matters not directly connected with the company's affairs.

An atmosphere of exclusiveness about the manager is bound to result to the company's detriment. His door should be open to anyone who is convinced that he must see him. If the manager has capable assistants he will find that this practice will not become as burdensome as might be supposed on first thought. If it is known throughout the city that he is accessible to the poor and rich alike this information will be of untold benefit to him and his organization. In reality only a small number of people will want to bother him about trivial matters.

The manager of a utility company in a sense occupies a position with reference to the people somewhat similar to that of the office of mayor. He has a varied constituency and he should endeavor as much as possible to come into contact with all the people and to obtain a sympathetic point of view.

In order that points of personal contact with the public in and about the office be of the most pleasant and satisfactory character, it is important that the arrangement of the office, the fixtures and the appointments be convenient and suitable. There must be a definite office system in effect on both sides of the counter so that customers may be handled expeditiously and waited upon promptly. The office force should understand clearly the correct disposition or reference of the various matters brought to the office in person by customers and prospective customers. There should be the smallest possible delays in directing people to the right departments and employes.

It is essential that one or more office men be assigned specially to the receiving and preliminary handling of complaints. Complaint or investigation men should be selected with great care and should be men of at least 30 years of age, married and with families. Only in rare instances does a younger or unmarried man or young woman possess the necessary experience with and insight into human nature to deal successfully with people who come to the office with grievances seemingly irreconcilable.

Many utility companies have found that telephone communications are among the greatest breeders of dissatisfaction on the part of the public. Individuals who are habitually polite to persons when they meet, often find it possible to be rude and uncivil when talking on the telephone.

It is often the case that a company will run along smoothly in its points of contact with the public except for two or three days at the termination of the period for the discounting of bills by prompt payment. On these two or three days the office will be crowded with people, and there will be a considerable amount of confusion, overworked clerks, short answers and disgruntled customers.

The congregation of customers in the office should be avoided as far as possible. The problem has been solved quite satisfactorily at some properties by changing the system of meter reading and billing so that a certain proportion of the bills fall due on every working day in the month. This equalizes the work, relieves the strain upon the office force, promotes more accurate work, has enabled a reduction in the number of employes and prevents a "peak" accumulation of customers in the office.

Failure of customers to bring their bills to the office when they make payment has caused considerable irritation to some of our local accounting departments. These customers who forget their bills are always the ones who come in on about discount day when a line is standing at the cashier's window. Making out of duplicates entails a digression from the regular order of business and unless specially provided for it throws the entire combination out of joint and delays the whole line.

From the standpoint of the local accounting department it may seem perfectly justifiable to print drastic warnings and threats upon the bills and to post somewhat undiplomatic signs about the office to the effect that "those who bring their bills will be served first; others must wait. Moral: always bring your bill." The justice of the matter does not appeal to the customer at all. He feels that when he goes to the office to pay a corporation, it ought to take the money at once and without deliberately trying to put him to inconvenience because he has failed to bring a slip of paper with him.

It is a good rule for every company that copy for all printed matter which will be seen by customers and public should receive the inspection and approval of the manager before it is placed in type.

The newspaper and other local advertising of utility companies to a considerable extent is accepted as expressing the spirit of the organization. A great part of the public sees the advertising frequently, while the average customer comes to the company's office not more than once a month. Even in plain commercial advertising there can be a certain tone indicative of the company's way of looking at things and how it regards its customers and the degree of satisfaction rendered.

The Commonwealth Edison Company of Chicago and other progressive organizations have insisted that no employe refer to the "rules of the company" as a reason why certain things were done by the company or certain things expected of patrons. Instead of talking about "the rules" employes were instructed to talk about the reasons behind the rules, and so far as possible to give the customer a true understanding of the conditions.

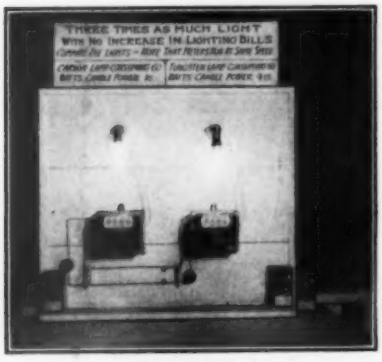
It is surprising, even in the smallest organization, how many differences arise between department and department and employe and employe. Men of one department will have a different idea of handling a contact point from the men in another department and if friction of this kind is allowed to make headway it will result in friction with the public as well.

In my opinion the best way to harmonize the efforts of the force is by

holding frequent meetings of those that come in direct contact with public, with the manager present. The points should be taken up one by one, fully discussed and if possible the manager should render a decision on the spot. After the meeting the minutes should be written up, approved by the manager and a copy placed in the hands of all interested.

With the development of new business departments and the active study of the customer's needs and the solicitation of business by trained men, a considerable part of the controversies between company and public have found their way to adjustment by the solicitors and salesmen.

The new-business department is one in constant personal contact with the public. Representatives of the company in this field are perhaps in a better position to know what the people are thinking about, how they see matters affecting the company and what they want in the way of service than any other department. Wherever the new business department is co-operating properly with the local organization it has been found of great value in improving public relations and creating public good will.



Meters Demonstrating Economy of Tungsten Lamps.

The profession of meter reading, I believe, is popularly understood as one of those that belong to men of brusque dispositions, untidy appearance and with a rough and ready attitude towards the world at large. Since meeting some of the young men who read meters for our companies, I have reached the conclusion that this is another one of the misconceptions which have caused utility operators anguish of mind.

There are many meter readers with the Byllesby companies who are as fine appearing and as alert and gentlemanly young men as can be found anywhere. There is no reason why employees who read meters or visit the homes of customers on any errand cannot be gentlemenly in their conduct and pleasing in their address.

Some years ago a prosperous company on the Pacific coast inaugurated what it called a "canvass of customers." They had representatives visit every customer and inquire if the service was satisfactory. These representatives also asked permission, regardless of the answer to the first question, to make an inspection of the gas and electric appliances of the household. They were prepared to make certain small adjustments and repairs. They also took orders for appliances but did not specifically solicit their sale.

This kind of canvass or inspection resulted in a great deal of good. It proved to the customer that the company was really desirous of knowing that the service was good. It resulted in many minor adjustments promoting satisfactory service, and in not a few cases the use of more service on the part of the customer.

A man who believes the sun is going to shine tomorrow and that the nation will endure, not only gets more happiness out of life but is more apt to enjoy competence and comfort in his old age, than the gentleman who wears blue glasses. In viewing the subject of public relations it is wise to take the happiest possible perspective of the situation; to accept the theory that human nature has more good than bad in it, and that the men and corporations prosper most who are most anxious for others to succeed and prosper.

The public utility business to go forward successfully in this country must proceed on the hypothesis that every customer may take his business away from a company if he chooses. It is immaterial to us how ordinary mercantile institutions treat their customers. We must, because we operate monopolies, treat our customers better than competitive business institutions and we must make it plain to the public that such is a fact.

A BEAUMONT, TEXAS, CENTRAL-STATION EXHIBIT.

By H. P. Jirou.

The Beaumont Electric Light and Power Company, of Beaumont, Texas, made an interesting demonstration at the South East Texas Fair, which was held at Beaumont from November 27 to December 6, 1911. The accompanying illustrations show how this company's exhibit showed up.

The ornamental posts were seven feet in height, capped with thirteen-inch frosted balls, each ball inclosing a 250-watt tungsten lamp. There were 420 five-watt frosted-ball tungsten lamps on the sides of the posts and 301 miniature carbon lamps in the sign. All woodwork was finished with three coats of white cold-water paint; and the usual household electrical devices were displayed on white tables placed inside, on either side of the entrance.

The electrically lighted Christmas tree placed near the center of the exhibit attracted a great deal of attention and resulted in the local sale of many tree-lighting outfits. The measuring instrument part of the exhibit proved to be an excellent method of demonstrating clearly and simply the advantage of using tungsten lamps.

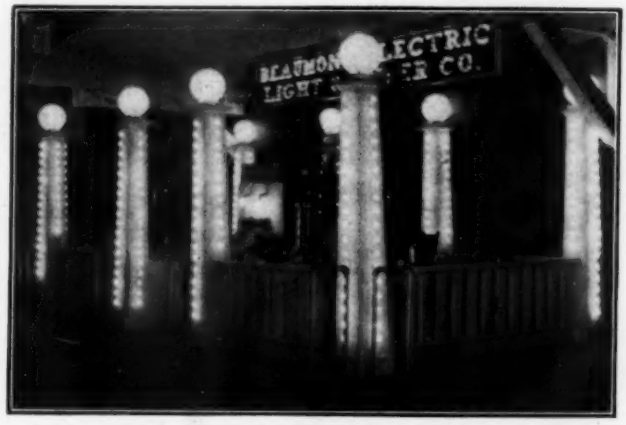


Exhibit of Beaumont Electric Light & Power Company.

Rates Cut in Yonkers, N. Y.

Yonkers Electric Light & Power Company, owned by the New York Edison Company and operating in the city of Yonkers, has made a voluntary reduction in rates. This is the sixth reduction since the company's organization.

The maximum lighting rate has been reduced from 15 to 13 cents a kilowatt-hour, and the maximum power rate from 13.4 to 12 cents a kilowatt-hour. The rates for automobiles, storage batteries and refrigeration are to be greatly reduced. The reductions apply to all retail consumers.

THE COMMERCIAL SIDE OF CENTRAL-STATION DEVELOPMENT.

By Henry L. Doherty.

It is a pleasure for me to congratulate the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN upon its new acquisition, and I send my sincere wishes for a prosperous new year to the journal and its readers.

Our firm issued a chart in lieu of a Christmas card to our clients and other houses engaged in the same line of business showing the progress made by different classifications of business during the past nine years. This chart showed that no class of business has made anything like the remarkable progress that has been made by the electrical business; and I received numerous personal acknowledgments of the charts which were sent out and the general tenor from many of the prominent men in the business was that we were to be congratulated upon being in such a progressive business.

The results achieved during the past few years in the electrical business have been nothing less than remarkable, and this progress has been due primarily to the awakening of the central-station manager to the value of commercialism along broad and comprehensive lines. With the increase in the volume of business has come engineering opportunities that did not heretofore exist, and the development of our commercial side has stimulated the engineering and the productive side to a wonderful degree. The modern commercial idea is as yet of no great age in its general application, and it is only reasonable to expect that the commercial spirit will be still further developed, while the activities which this commercial spirit have inspired have not as yet borne even a normal harvest.

In this work which has been of so much benefit to all of us we have had the hearty support of the trade press, and we have profited to a large degree by the progressiveness and the intelligence the trade press has shown. We, as central-station men, have learned the value of high-class advertising, or high-class publicity of any character.

Practically every central station in the country has become, directly or indirectly, distributors of all classes of goods which utilize electrical energy, and it is in the trade press that we must look for those who in turn want to reach us, and we should give the same attention to the publicity of the man who wants to reach us as we would like to have the man give whom we are trying to reach.

The great, big market today for electrical goods is no longer the generating station, but is the apparatus used on the consumers' premises. We should do everything we can to stimulate the manufacturer and the inventor to give us new or improved apparatus, and especially apparatus that will find new uses for current. We, as central-station men, should employ every possible avenue to stimulate the development of our business—and especially give our support to the efforts of the trade press.

I would hesitate to attempt to suggest the numerous new uses, or extensions of old uses, which I can see for electric energy on the consumer's premises. I do, however, feel that the high-class home, hotel or office building of the future will have in addition to its heating and ventilating system a heating, ventilating and refrigerating system, whereby the air in the summer time will be tempered to our comfort in the same manner as we temper the air in the winter time. This alone is an enormous field for electric energy, especially in the South. This is the particular thing that I am personally working on at present, and it is interesting to note that the power consumption need not be beyond the possibility of even our most modest consumers.

If each of us will attempt to develop something, either large or small, that will find new uses for electric energy, or extend the uses which are already in vogue, we can make even a more marvelous showing in the rate of increase than has already been accomplished.

Concerning Courtesy.

The Louisville Lighting Company has issued the following, which has been adapted from a statement published by the Lackawanna Railroad.

The following expression to its managers, receiving clerks, solicitors, meter readers, cashiers, messengers and other representatives indicates the attitude of this company on a subject of vital interest to its patrons:

The possession in marked degree of any worthy faculty should always be an incentive to develop that faculty. This company considers that representatives possess the faculty of being courteous to the public above the average. To those who cultivate and exercise this faculty the company extends its congratulations and its thanks. To those who may not have fully appreciated its importance, thoughtful consideration of the following is suggested:

First. The principle that underlies courteous treatment of others is simply that of doing unto others as you would they should do unto you.

Second. In a highly complex and technical business such as that of a lighting company there are many things that you, with your training and daily experience, understand with perfect familiarity, but which the public do not understand. Therefore, do not assume that the public should comprehend them without asking questions, but when they do make inquiry of you, give them the courtesy of a reply just as full and clear as you can make it, and without any suggestion of superiority born of a greater knowledge.

Third. Words are only one means of expression, and manner is quite as important. Therefore, remember that a kind and gracious manner is not only the sign and mark of a self-respecting man, but is to your words what oil is to machinery in making them move effectively to their purpose.

Fourth. True courtesy is no respecter of persons. It remembers that "a man's a man for a' that," and gives the civil word and the helping hand quite as readily to the ill-clad stranger as to an official of the company.

Fifth. Courtesy is not only something that the public have a right to expect of you, but it pays.

It pays in the friends it makes you personally and as a representative of the company.

It pays in minimizing the friction of your life, as well as that between the company and its patrons.

It pays in raising your standing with the company.

It pays in the personal satisfaction resulting from having done the right and kindly thing by your "neighbor."

It is the wish of the management of this company that all its representatives whose work brings them into contact with the public, may appreciate and fully measure up to their duty and privilege in this respect.

Boosting Electric Percolator Sales.

Taking advantage of the fact that a large percentage of its customers pay their bills on the tenth day of the month, this being the day that the discount period expires, the Rockford (Ill.) Electric Company has recently put into effect a plan that materially increases the sale of electric coffee percolators.

A demonstrator, located near the cashier's window, serves electrically cooked coffee and toast to all who enter the office and explains to those interested the conveniences of the percolator. A special low discount-day price is made on all orders taken on that day. On the tenth of November, twenty percolators were sold in this way, only five being in use up to this time. The same plan will be tried for various other appliances.

Electrical Construction

NOTES ON ELECTRICAL CONSTRUCTION.

By George J. Kirchgasser.

This is the second of a series of articles on electrical construction. The matter will be treated in a thoroughly practical manner, and will cover every phase of construction usually encountered by the electrical contractor or the electrician in an industrial plant. This article discusses in detail some of the usual types of interior wiring.

Systems of Interior Wiring.

Often in wiring a building a considered under seven distinctive heads:

1—Open work: (a) knob wiring; (b) cleat wiring.

2—Molding: (a) wooden; (b) metal.

3—Concealed knob and tube wiring.

4—Fished flexible tubing.

5—Iron conduit.

6—Flexible steel conduit.

7—Armored conductor.

Often in wiring a building a combination of some of the above systems is used; in some portions of the building iron conduit may be used, while in others flexible conduit, armored conductor or concealed knob and tube work may be employed, thus making a mixed wiring job.

In open wiring systems the wires are exposed to view. In the open knob system the wires are supported

Fig. 1—Two-Wire Cleat.

and insulated by porcelain knobs, and in the open cleat system by porcelain cleats. These open-style systems are similar except for the means of supporting the wires, and are the cheapest and quickest to install. For some purposes and where good appearance is not very essential, they provide very satisfactory methods. In factories, store rooms, industrial plants, barns, open sheds, out-houses, etc., they are employed to a great extent. In installing them care should be exercised to string the wires tight and in straight lines. Taps to lights, switches, etc., should be run either at right angles or parallel lines to the main runs. If the wires are run in various directions, making all sorts of angles with each other, the appearance will be unsightly and the tracing out of the circuits will be made difficult.

Cleat Wiring.

Fig. 2 shows part of an open cleat system and the method of employing the cleats, the location of the main fuse and switch, the branch fuses and the means of insulating the wires where passing over each other or over a gas pipe. As the pipe is metal, the wires must be insulated from it. To hold the porcelain tubes which are used as insulators, a cleat can be placed at each end or friction tape can be tightly bound around the wire. The idea is to provide means for keeping the tubes in place. Note also that a tube is used where one wire crosses another. Wherever a joint is made or rosette or other device used means must be provided for taking up the strain. In the cleat system a cleat is used as shown in Fig. 2. Thus strain on the joints or binding posts of the rosette is prevented.

Fig. 1 shows a common two-wire cleat in which the wires are held two and one-half inches apart and one-half inch from the surface wired over. Where the voltage is not in excess of 300, this type of cleat may be used. There are two parts to this cleat, and two screws hold the top of it and the wires in place, and also the whole cleat to the surface over which the wires are run. A three-wire cleat is also manufactured, this being similar to the two-wire type, except that a third notch is located between the two outside ones. The neutral wire is placed in the middle notch where the voltage between the two outside wires is not over 300, and the distance between neighboring wires is not less than one and one-half inches. Single-wire cleats are used where the wires and cables are larger than can be accommodated in the ordinary cleat or knob. The cable or wire holes in ordinary cleats and knobs vary from one-eighth inch to five-eighths inch—these being in special types—and are corrugated to grip the wires.

Open wiring should only be run where there is no danger to the wires from mechanical injury. Cleat wiring, moreover, should only be run in comparatively dry places, because moisture is a good conductor of electricity and might allow the current to leak across from one wire to the next. For cleat wiring, rubber-covered, slow-burning weatherproof or slow-burning insulation may be used. The wires should be well supported; in some cases a cleat every three and one-half feet is necessary, and in others a spacing of four to five feet is sufficient.

Cleat wiring must not be concealed; that is, run between the floor and ceiling or between walls. Where it is liable to mechanical injury, as is often

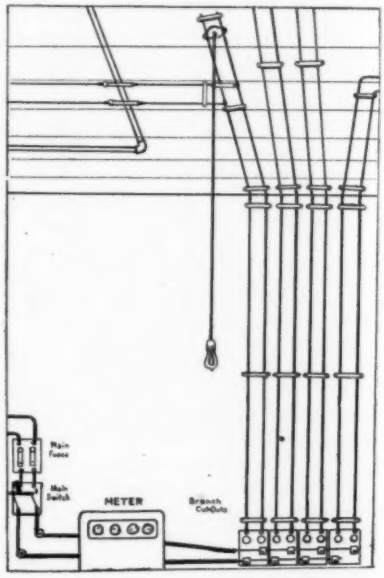


Fig. 2—Cleat Wiring.

the case on low ceiling, guard strips about three-quarters inch wide and one inch high should be run parallel with the wires and about one inch away from them. On open-joist ceilings a running strip is often used to prevent side blows and prevent anything being hung on the wires. This running strip should be about three-quarters inch thick and four to five inches wide. It is first secured in place, after which the cleats are secured in the usual way. On side walls, below about five to six feet from the floor, suitable boxing is necessary if open wiring is employed in order to protect the conductors from mechanical injury. Only metal conduit is permitted in the wiring of elevator shafts.

Open Knob Wiring.

In open knob wiring knobs are used to support the wires one inch from the surface wired over. These knobs are usually of the glazed-porcelain, split type, each knob having one or more grooves for wires. Fig. 4 has only one groove. Two to four grooves are formed by the two sections of some knobs and these are of different sizes to accommodate wires of various gauges. The positive and negative wires of a circuit must not be supported by the same knob, except for certain kinds of temporary work.

The one-piece tie knob, Fig. 5, was used to a considerable extent formerly, but because of the greater ease and speed possible in wiring with split knobs, the solid knob is used very little now. It is not approved except at dead ends for wire smaller than No. 8 B. & S. gauge. When used at all the circuit wire is placed in the groove and a tie wire employed to secure it in place. This tie wire should have the same insulation as the circuit wire so as not to abrade or injure the latter.

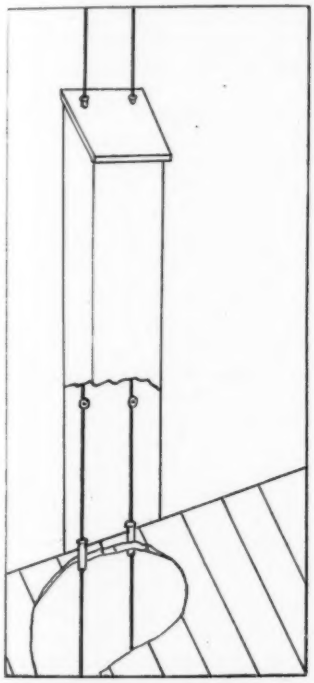


Fig. 3—Protection for Wires on Walls.

As mentioned above, a voltage of 300 is the maximum limit for ordinary cleat wiring. Above this voltage and up to 550 volts knobs holding the wires one inch from the surface wired over and set apart from four to five inches are required for open work. Higher voltages sustain greater arcs and are more liable to arc over so that a greater separation between wires of opposite polarity is desirable. Pairs of knobs are placed about the same running distance apart as cleats, that is, about four to five feet. The inch separation from the surface wired provided by knobs make them

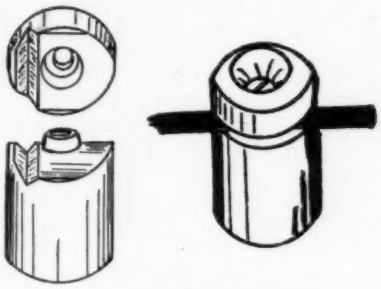


Fig. 4—Split Knobs.

better proof against attacks of moisture than cleats.

Ordinary weatherproof wire can be used in open knob work, but where moisture is prevalent rubber-covered wire is best, and where acid or other fumes prevail, rubber-covered or

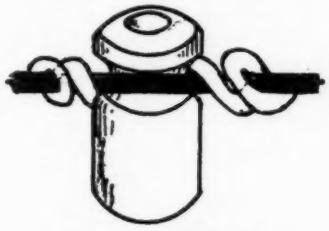


Fig. 5—Solid Knob.

weatherproof wire is permitted. In these places the insulation on the wires will deteriorate faster and therefore should receive attention at regular intervals.

Several methods of protecting open wiring, either cleat or knob, on side walls are employed. Fig. 3 shows the use of a wooden boxing (three-quarter-inch board) with the top made slanting to prevent dust from collecting on it, and also to prevent its being

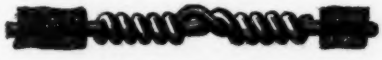


Fig. 6—Method of Making Splice.

used as a shelf. Porcelain tubes bush the holes and are taped to keep out dust. Fig. 7 shows a piece of iron conduit, with a type "A" condulet fitting at the top, used to protect the circuit. At the bottom an ordinary conduit box is shown. Hard-rubber, composition or porcelain battery bushings may be used where the wires leave the wooden box at the lower end. Either of these fittings could be used at both ends. Two were shown for variety's sake. Where unlined conduit is used, double-braid, rubber-covered wire must be used. Fig. 7 also shows an iron pipe used for the same purpose, the pipe being large enough to accommodate the two wires, each of which is independently inclosed in a single length of flexible tubing. This tubing protects the insulation on the wires and should butt against the upper and lower cleat or knob as the case may be. The protection for the wiring should always be carried up five feet from the floor, or more if the circumstances demand it.

Open wiring is cheaper than other wiring, with the possible exception of wood-molding work, which for some purposes is also entirely satisfactory.

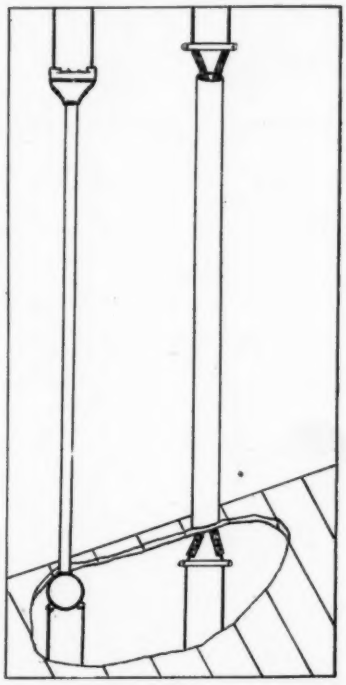


Fig. 7—Another Method of Protecting Wires on Walls.

Open wiring is easy to install and takes less time than concealed work. To look neat the wires must, as already stated, be strung tight and in symmetrical lines, and taps must be made at right angles. If repairs are made when defects first show up, and cleats or knobs replaced when necessary, the life of open wiring will be greatly increased. Splices and joints must be wel made—see Figs. 6 and 10—soldered and properly taped. When rubber-covered wire is used it is best to bind the splice or joint with rubber tape first and around this use friction tape. A coat of asphaltum paint over this latter is especially good in damp locations or where acid or other vapors are apt to be present. With other than rubber-covered wire the rubber tape is usually omitted.

Soldering should be done with a

blow torch so that the solder will be sweated in between the turns of copper and not just be formed in a lump on the outside. The solder should preserve the joint.

Wooden Molding Construction.

In molding wiring, although the wires are concealed, molding is exposed; so this system is not referred to as a concealed wiring system. Wooden molding consists of a backing which for common two-wire circuits

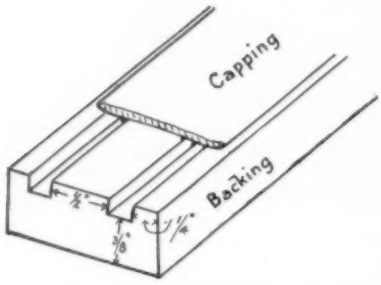


Fig. 8—Wooden Molding.

has two grooves separated by a tongue one-half inch wide, as shown in Fig. 8, and a capping which is nailed to the tongue by small nails and holds the wires in the slots. From the illustration it will also be noted that there must be three-eighths inch between the bottom of the slot and the lower surface and one-quarter inch on each side of the slots. For wiring to three-way switches, and for three-wire systems, etc., a three-wire molding is made. Soft wood is used most generally in making wooden molding,

Fig. 9—Taplet for Molding.

although hardwood is preferable, since it is stronger and not so apt to absorb moisture. In all cases, however, molding must be thoroughly coated with a waterproof or moisture-repelling material, such as shellac.

Single-braid rubber-covered wire is used in wooden molding, weatherproof or fireproof wire not being permitted by the National Electrical Code. As the wires are in intimate contact with the molding the rubber insulation is considered superior to the others. In making splices the wires are twisted together securely, soldered and then wrapped with both rubber and friction tape. It is best to use such lengths of wire that splices will not be necessary.

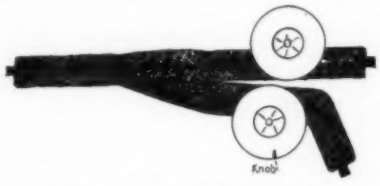


Fig. 10—Branch Connection.

The backing of the molding is first secured in place (screws being preferred to nails), then the wires are laid in and the capping nailed in place.

DIMENSIONS OF STANDARD WOODEN MOLDING.

Size of Groove in Inches	Number of Grooves	Size of Wire B. and S. Gauge.	
		Solid	Stranded.
1/4	2	Nos. 14 to 12	Nos. 14 to 12 (seldom used)
5/16	2	Nos. 10 to 8	No. 8
7/16	2	Nos. 8 to 4	No. 6 and No. 5
9/16	2	Nos. 3 to 0	No. 4 to No. 1

Molding is also made standard with three grooves of sizes like above.

Where a tap is made approved taplets must now be used. Formerly a part of the tapping was cut away and the wire brought out over this, but the requirements have changed so that taplets or some other approved device must be used. The splice is better protected and the appearance is also improved. Fig. 9 is an illustration of a Paiste taplet.

Wooden molding is inexpensive and while not as good as the concealed and conduit systems, it presents a better appearance than the open knob and the cleat systems. The molding also can be painted over to match any ceiling or wall and if it is run in a neat manner, is suitable for stores, offices of the usual type, etc., but not for homes or richly appointed offices.

Molding must never be concealed in walls, between floors, etc., but must always be exposed. It must not be used outside or where there is apt to be moisture—as, for example, in barns, slaughter houses and breweries—for here the wood would in time absorb moisture and as moisture is a conductor of electricity, current leakage and other troubles would follow. Neither should molding be used where it is liable to receive mechanical injury, since the capping is easily broken. Hence on side walls it should not generally be used below a point six feet above the floor. Where used in residences or offices this restriction is waived, but a kick or mop plate is required at the floor. When run on the inside of an exterior brick wall, a backing usually of one-half-inch wood is first secured to the wall, to which the molding is then attached. The reason for this is that a brick wall "sweats" under certain conditions, so that the backing is necessary to separate the molding from the wall and keep it dry.

EXAMINATIONS AND TESTS OF RUBBER-COVERED WIRE.

By Hugh T. Wreaks.

For the last several years the rubber-covered-wire industry has been badly demoralized, insofar as much inferior wire has been sold under various specifications. This is probably due to the fact that new processes were continually obtaining whereby rubber compounds could be cheapened, through the use of adulterants, inferior to either new or reclaimed rubber, and which compounds, when first made up and sold, showed many, if not all, of the characteristics of good, *bona fide* rubber compounds.

This situation has, naturally, been distasteful to the better class of rubber-covered-wire manufacturers and also to the fire underwriters, permitting, as it does, the introduction into buildings throughout the country of such wire, the insulation of which is inferior in quality.

The situation has been recognized for some time by the electrical trade, as well as by the manufacturers, fire-underwriting interests and inspection departments throughout the entire country; but, owing to the divergent views as to the remedy, no proper corrective measures have, as yet, been applied, although these remedies have been in process of development since early in 1910.

The first public step that was taken in this direction on National Electrical Code wire was the action of the City of New York which, late in 1910, published what were known as the New York City Specifications. The next official act was, early in 1911, the publication by the National Fire Protection Association of the 1911 National Electrical Code Rubber-Covered Wire Specifications; these having been, later, adopted by the National Board of Fire Underwriters.

Both of these specifications marked a distinct advance over the old 1909

Code and both had much in common, although varying in certain details, due probably to the fact that the framers of each of these specifications approached the problem from somewhat different points of view. As a matter of fact, however, these two specifications are in no way antagonistic and, from the writer's point of view, every test called for in either has a proper application to rubber-covered wire used in wiring houses.

So much was this the case that the New York City Specifications, presumably in the interest of uniformity, have subsequently been modified so that the same compounds can probably be used on rubber-covered wire called for in either specifications.

After the adoption of, practically, a uniform specification usable throughout the entire country, there still remained the necessity of devising some method of enforcement, through inspection and tests, so that the use of as little wire that did not conform to the specifications as possible should be permitted in house wiring.

To make such an enforcement practical, it was necessary that the manufacturers of rubber-covered wire and the Underwriters' Laboratories should agree on a single inspection service to see to the proper enforcement of the new specifications throughout the country, and, after several conferences, this agreement was finally reached and is detailed herewith substantially as follows:

Single Inspection and Tests.

"A method of procedure to be agreed upon covering all inspections and tests on rubber-covered, National Electrical Code wire."

This has been accomplished.

"All changes in specifications and procedure in connection with rubber-covered wire to be in the hands of a sub-committee on rubber-covered wire of the National Fire Protection Association, which committee is to consist of six members; three to represent the Underwriters' Laboratories and three to represent and be nominated by the manufacturers subscribing to the Underwriters' Laboratories inspection service for rubber-covered wire.

The Rubber-Covered Wire Committee of six to pass not only on specifications on rubber-covered wire, but also on the Laboratories' interpretation and enlargement of these specifications, as covered by the Laboratories' standards used in connection with inspection at factory.

"Old-Code wire shall cease to be labeled on December 31, 1911. And old-Code wire made after that date shall have no stamps and shall have the words '1909 National Electrical Code Standard' printed on the tags. No old-Code wire shall be offered for sale, as such, after July 1, 1912.

"That on and after January 1, 1912, the wire manufacturers now taking Wire Inspection Bureau service on National Electrical Code rubber-covered wire will abandon same, and, futher, a large majority of such manufacturers will subscribe to similar inspection label service of the Underwriters' Laboratories.

"This latter inspection service to be promptly obtainable by the manufacturers applying for same, provided his wire conforms to the 1911 National Electrical Code rubber-covered wire specifications.

"In addition, Secretary Wreaks, of the Wire Inspection Bureau, to go over to the Underwriters' Laboratories on January 1, 1912, as a specialist on rubber-covered wire, and the other members of the Fire Inspection Bureau force to follow as rapidly as the new service can be developed. This, practically, is a merger of the Wire Inspection Bureau, National Electrical Code Rubber-Covered-Wire Service with that of the Underwriters' Laboratories; the latter, in their new service, being able to utilize such experience as the Wire Inspection Bureau has developed during the last several years."

Importance of Merger to Electrical Industry.

To any one who has closely followed the rubber-covered wire situation during the last few years the importance to the electrical industry of the merger outlined is quite apparent. To one who has not, a recitation of a few of the salient points will doubtless be of interest.

In the manufacture of rubber-covered wire, especially of late years, the use of various adulterants instead of pure rubber had been quite common. At first these adulterants were confined to reclaimed rubber or high-grade shoddy; but, of late, with some manufacturers, the tendency has been to use shoddy of a continually lower grade. And, in addition, substitutes other than shoddy, so-called mineral rubber, have lately largely come into vogue.

These adulterants produced a compound which, under the specifications in existence for house wire up to this year, compared favorably with compounds made up from high-grade material; this, especially when new.

These cheap and adulterated compounds tended. however, to dry out rapidly and so lost their electrical and physical values.

The new 1911 National Electrical Code specifications prescribe tests designed to prevent the use of such adulterants. This is to be accomplished in two ways—first, through a series of tests at factory, electrical, physical and chemical (these tests are to be made on compounds used in new wire); and second, a similar series of tests made on similar wire after same has aged for several months or a year.

There is little question that the initial tests called for in the specifications will, when rightly enforced at the factory at the time the wire is first made up, will do much to insure the use of good material, and with a proper follow-up system of making similar tests on the same wire after aging, and as called for in the procedure agreed upon, there is no doubt but that a very superior wire will obtain. And such a wire will not only be available for house wiring, but probably will also be of service in a good deal of the signalling work throughout the country.

To better understand exactly what the procedure in question means, a few salient points are outlined herewith.

The General Scheme of Examination and Test.

The procedure is divided into four sections; the first, covering the general plan of the factory inspection service; the second, inspection at factory and use of labels; the third, chemical and field tests; the fourth, analysis of results.

The first two sections are largely recapitulations of various details covering actual work of inspection and would hardly be of public interest. This, except as concerns stock tests, which mean that after material has passed a regular inspection and test at factory and is put away as stock in factory, that a certain percentage of these stock coils are, later, subjected to the same electrical and physical tests.

Similarly, coils of wire are bought in the field; from one to two coils per month of each manufacturer, according to his size, and subjected to above tests.

Every three months, results of these tests, together with other tests enumerated below, are summarized and percentage defective obtained and the manufacturer's product is then judged by a system of demerits based on this "percentage defective" as brought to light under an analysis based specifically on the following tests:

(a) Electrical tests on stock coils.
(b) Electrical tests on field coils.
(c) Physical tests on samples from stock and field coils (new wire).
(d) Physical tests on samples from stock and field coils (old wire).
(e) Thirty-day tests on stock coils.
(f) Chemical tests on samples from stock and field coils.
(g) Wrapping tests on samples from stock and field coils.

Critical Points.

In each of the classes of tests, (a) to (g) above, the product is said to have reached the critical point when

the results for given periods are found below the specified limits. This is expressed in "percentage defective."

Demerits.

Whenever defective samples are found, through the various tests, demerits shall be recorded varying with the class of tests and according to tables of ratings which have been prepared.

Whenever the total amount of demerits recorded against any product for specified periods amount to or exceed the limits established, further product will not be labeled until the manufacturer shall have shown that the same is in accordance with all requirements, by subjecting it to such special tests, either at factory or laboratories, or both, as may be considered necessary for such cases.

This schedule of demerits is divided into three sections; the first, for the analysis of all tests extending over any consecutive three-months period; the second, for similar analysis extending over any six-months period; the third, for analysis extending over any consecutive one-year period. The sum of demerits calling for withdrawal varies with each period.

The system is, naturally, designed to judge as nearly as possible the actual worth of the material which a manufacturer is turning out, and it will, unquestionably, check any manufacturers who attempt to put out an inferior product. It is not designed to be so difficult that any manufacturer cannot comply with same, but to cause those manufacturers whose demerits are totaling, for a short time, a number exceeding the total allowed for any given period to take active steps and make material sufficiently improved to reduce these demerits during the balance of the period. The experience that the Wire Inspection Bureau has already had with a similar but less comprehensive system indicates that this method will be quite successful in accomplishing results desired in maintaining the quality of the wire put out under the new specifications.

So much for the specifications and method of procedure, which would seem to thoroughly cover the ground that inspection departments throughout the country will be warranted in demanding a wire conforming to the requirements of the service outlined.

Practical Applications of the System.

The City of Chicago and the City of New York have already taken this step. This is outlined by a letter of William Carroll, city electrician, Chicago; and H. S. Wynkoop, city electrician, New York, as follows:

"Chicago, Ill., September 25, 1911.
Dear Sir:

Please take note of the following change in the specifications for rubber-covered wire, a copy of which is enclosed:

After January 1, 1912, all wires in sizes from No. 14 to No. 4/0 B. & S. gauge must comply with the new specifications.

After July 1, 1912, all wires in sizes from 250,000 circular mils up must comply with the new specifications.

The following exceptions will be made on all contracts signed previous to the date of issuance of this notice, (Sept. 25, 1912)—wire complying with the "municipal specifications" may be used, provided all such contracts are listed with this department within fifteen (15) days.

(Signed) Wm. Carroll,
City Electrician."

"New York, N. Y., November 27, 1911.
Dear Sir:

After January 1, 1912, the New York City specifications will be stiffened by the addition of the stretch test, but this test will not be applied to wise used on installations for which the contractors have filed application prior to January 1. We are making no distinction between wire sizes in this matter.

(Signed) H. S. Wynkoop,
Electrical Engineer."

In the writer's opinion, the only reason which any inspection department in the country can offer against the use of this new 1911 specification wire is that it costs more than the old-Code wire and that the old-Code wire specifications could be strengthened up in various particulars (presumably along the lines of original New York City specifications) and make a wire which was safe from an electrical viewpoint for ordinary house-wiring purposes and not as expensive as the new wire. This is a contention which has been flatly disputed by some authorities and maintained by others, and although the writer is inclined strongly to the latter opinion, it is unquestionably a fact that the New York City specifications would have been of no value whatsoever unless tried out with a comprehensive follow-up system similar to that outlined in the new plan and, owing to the divergence in views as to the efficiency of these New York City specifications, such comprehensive service was impossible of attainment. Therefore, it can be stated, I think, without any question, that the new combined specification service is a decided step in advance over any other solution previously offered or adopted and cannot fail in its use to, in the aggregate, produce a much higher grade and electrically safer and more efficient wire than is being made up now and has been made up in the past, under the old-Code specifications, combined with such inspection service as has been obtained. I make this statement with the realization that admirable wires have been produced under the old plan; wires which would compare favorably with any that will be produced under the new plan.

It is, of course, too early to predict what the future has in store, but it is believed that the data to be gathered and research work to be made under the new plan will help materially to bring about a solution of even the cost question which will be entirely satisfactory to the entire electrical trade.

To illustrate: The specifications today contain electrical tests and physical tests to be made on wire when new and to be made on wire when aged, and the plan provided that these tests will be made so frequently and carefully on typical samples that evidence will accumulate showing the real service value of every compound made up under the new specifications. On all such samples, chemical tests will have been made which will be searching enough to serve, in a large measure, when taken with the other tests, as identification tests of individual compounds, and little argument need be made to show that the moment identification tests of new compounds by chemical tests is sufficiently developed to be entirely dependable, service value will then be the only requirement which need be called for in specifying any grade of wire.

This condition will obtain the sooner the more active support of new specification service obtains by inspection departments and the electrical trade over the country, and, granted that this attainment is desired by inspection departments and the electrical trade, it is hard to see any other as effective or quick way of so obtaining it.

In other words, a uniform standard of quality must not only be specified but enforced throughout the country to such an extent that manufacturers can depend upon it and that the joint efforts of all concerned will be toward a fixed condition of specifications and inspection so that that they may properly plan to meet this fixed condition. And, while maintaining such fixed condition, it would also seem important to put proper emphasis on service value of material as the ultimate aim of any specifications, and with this understanding arrived at and accepted the cost of material of real service value cannot fail in a relatively short time to reach its proper level.

Inspection and Test of Wire After Installation.

In this whole scheme outlined, one very important factor has been omitted which it would seem advisable to sketch out, and this is with respect to what happens to the wire after it is made, inspected and tested and comes into the hands of the jobber and the contractor. It is not the purpose of this scheme to insure material against abuse or to do more than its share in helping to obtain a good serviceable material, but it would seem improper

not to point out, at this time, a way in which abuse of rubber-covered wire may be properly checked in installations.

The National Electrical Code, page 168, paragraph 88, specifies tests which should be made on the wiring in any building, and it is the writer's experience that these tests are not sufficiently or properly made by inspection departments in the field to serve their purpose. This is partly for the reason that it has been claimed that these tests only partially tell what has happened to the wire after it is installed. This is true, but experience to date shows that if these tests were supplemented by dielectric tests at a potential three or four times that of the service current and by a more systematic record of the make of wire used in various installations, that extremely valuable checks would be placed against the abuse of rubber-covered wire to the process of handling after it leaves the factory and in installing in buildings.

It is realized that such tests cannot be made with sufficient thoroughness in every building, but there is no question but that, if they were made systematically on typical buildings selected at random, they would serve practically the same purpose. This, I understand, is now being seriously considered by New York City. There is no reason whatsoever why records cannot be kept of the make of wires used in different buildings, as the distinctive marking on all wires today clearly indicates, by whom they were manufactured, and if they fail to so indicate by the marking being imperfect it would seem reasonable that, for the public safety and in justice to the entire industry, such wire should not be allowed to be used.

In closing this article, it would seem proper to indicate a little more clearly what experience has shown to be the essential requirements so far as characteristics of rubber-covered house wire are concerned. These are that the copper resistance shall be and remain indefinitely as specified; that the insulating covering shall, up to the time of installation, possess such physical qualities as not to be capable of injury in ordinary handling, and also possess an electrical value (as shown by dielectric and insulation resistance tests) constituting a reasonable factor of safety above the electrical strains they will be subjected to in use; and that it will maintain these physical and electrical qualities without material impairment for the longest period of time under ordinary service conditions. The function of the tin is to protect copper from corrosion. The function of the braid to protect the insulation.

These points are covered, and well covered, by the new 1911 Code specifications and inspection plan outlined. While the rate of change, physically and electrically, of compounds used on wire may be more important than the actual characteristics, provided they are above a certain limit, yet, the means of watching and checking this rate of change are, if anything, still more important, and such means are provided in the scheme outlined, and it should receive the unqualified support of every one whose interests are involved, at least until such time as better and more effective means are produced.

Insulating Tape.

The following specifications recently issued by the United States Navy Department cover the requirements applying to insulating tape purchased by the department. These specifications supersede those issued May 22, 1907, Oct. 3, 1908, and July 11, 1910. They enumerate very completely the properties essential to high-grade tape.

1. Tape to be classified as follows:
(a) Rubber tape.
(b) Cotton tape.

2. Both classes must meet the following requirements:

(a) Deliveries shall contain full specified weight of tape, exclusive of wrapping and boxes. Net weight only of tape shall be paid for.

(b) All tapes shall be of recent manufacture.

(c) The surface shall be smooth, the body entirely free from holes, the edges straight without selvage and widths even. When held before a strong light there must be no evidence of pin holes.

(d) The wrappings shall be secure and protect the contents fully.

3. The cotton tape must be well saturated and frictioned, but compound shall not be put on in excess. Separation under a pull of two pounds per inch width applied to the material when wound from the original in a coil on a ¼-inch mandrel under a tension of ten pounds shall not exceed eight inches per minute at seventy-five degrees Fahrenheit.

4. When unwinding from the original coil there must be no tendency to leave a thread sticking to the next layer in the case of cotton tape, nor shall the separator show any tendency to stick in the case of rubber tape. Rubber tape, when wrapped to a thickness of one-quarter inch and heated to 150 degrees F. for 20 minutes, shall fuse into a homogeneous mass.

5. Cotton tape, when exposed in strip to dry heat at 210 degrees F. for sixteen hours shall stand the following separation test immediately after removal from the heat. Test similar to that in paragraph three will be made, except that the pull shall be two ounces per inch width and the separation shall not exceed three inches per minute.

6. The weight of the compound applied to the cloth shall be about 0.65 pound per square yard.

7. To possess the following physical and chemical characteristics:

Width, inches: Rubber, ½, ¾, and 1; cotton, ½, ¾ and 1.

Thickness, inches: Rubber, 0.035, approximately; cotton, 0.015, approximately.

Package, pounds: Rubber, ½, ½, and 1; cotton, ⅜ to 2/3 all widths).

Length of tape per pound weight (minimum): Rubber, 27, 18, and 13.5 yards; cotton, 72, 48, and 36 yards.

Para rubber: Rubber, not less than thirty per cent.

Sulphur: Rubber, not more than 3½ per cent total.

Ash by burning: Rubber, not to exceed sixty-five per cent; cotton, not to exceed forty-five per cent.

Tensile Strength: Rubber, 400 pounds per square inch at seventy-five degrees F.; cotton, forty pounds per inch of width.

Dielectric Strength: Rubber, 250 volts per millimeter of thickness five minims); cotton, 1,000 volts (5 minims).

Color: Rubber, black; cotton, black:

Layer separation: Rubber, linen or glazed cloth.

Packing: Rubber, oil paper or tinfoil; and in pasteboard box; cotton, tissue paper or tinfoil and in tin box.

Markings of package: Rubber, maker's trade name, width, weight, directions; cotton, maker's trade name, width.

The test for tensile strength of the rubber tape shall be performed on a rubber testing machine, the rate of separation of the jaws which clamp the test piece being 3 inches per minute. The initial distance between the jaws shall be 3 inches. The test for tensile strength of the cotton tape shall be conducted with a textile testing machine or by lifting the specified weight.

The dielectric strength tests to be conducted as follows: The test piece to be placed between two electrodes consisting of two brass balls, each 2 centimeters in diameter, and the specified alternating potential having an effective value, at a frequency of sixty cycles, shall be continuously applied for five minutes and no breakdown shall result. The electrodes must be brought close together, so that the tape will just move between them.

Among the Contractors.

The Thomas Day Company, of Mission street, San Francisco, has been awarded a contract for electric fixtures in the new building of the Masonic Temple Association, on Van Ness street in that city. The cost of the fixtures will be $2,122.

Henry Newgard & Company, electrical contractors, of Chicago, are installing the electrical work in the new factory of the Corn Products Refining Company, at Argo, Ill. The job includes the installation of a complete power plant, several hundred horsepower in motors and a conduit wiring system for motors and lights.

The Central Electric Company, of Battle Creek, Mich., have secured the contract for wiring a large, new factory for the Michigan Carton Company, also of Battle Creek. These

contractors are also engaged in completing the installation of an ornamental-standard tungsten lighting system on Main street in Battle Creek.

A. S. Schulman & Company, of Chicago, are installing the electric wiring in the Insurance Exchange Building, which is being erected on Jackson Boulevard, Chicago. When this work is finished there will be a total of twenty-six hundred circuits. There will be seventeen electric elevators and 1,000 horsepower in motors. A new type of oval conduit will be used on ceiling outlets, and varnished cambric insulation will be used on all mains and feeders.

The Smith Electric Works, 136 American Avenue, Long Beach, Cal., has been organized to furnish wiring, fixtures, etc., and to engage in the electrical contracting and repair business. W. H. Mason is general superintendent.

Kilpatrick & Hotz, Bridgeport, Conn., have the contract for installing the electric lighting plant with which the Gulf Refining Company are to have their plant on the banks of the Housatonic River lighted. This work will be taken up at once and the electric lights will be ready for use shortly.

The Mount Zion Hospital has awarded the following contracts in connection with the erection of its new hospital at Post and Scott streets: power plant, heating and ventilating system, etc., Atlas Heating & Ventilating Company, Fourth Street, $14,760; electrical work, Butte Engineering & Electric Company, 683 Howard Street, $7,592; two passenger and one service elevators, Otis Elevator Company, Beach Street, $12,700. A.

The Roberts Manufacturing Company, San Francisco, Cal., has been awarded a contract for the installation of electric fixtures at the temporary City Hall Building at a cost of $4,889. A.

The Pacific Power & Light Company has been awarded a contract for installing and maintaining an electric lighting system here. A.

Overton & Tuthill, Riverhead, N. Y., has incorporated to do electrical construction work. The capital is $8,500, and the incorporators are George W. Hildreth, Myron E. Overton, George Conklin and Joel Woodhull.

Pierson Roeding & Company has secured a contract for 48 double trucks for electric cars from the San Diego Electric Railroad.

WHAT CAUSED THE SPARKS?

By A. K. Brake.

We were recently inspecting the rough wiring in a new residence and were surprised to find a very decided spark—in fact, numerous sparks—occurring whenever contact was made between the gas pipes and water pipes in the building. This was called to our attention by a plumber on the job, who had accidentally connected the two systems by his iron wrench handle and had noticed the "sparks." The conditions existing in the building were as follows:

A new two-story residence, not yet completed, all lathing done and plasterers at work; located on low ground; gas plumbing all done and meter connected. Gas in lines. Water plumbing nearly all done and water turned into lines, hot water from same being used. Rough electric wiring done but no fixtures installed, and no service connection. No telephones and no telephone wires in building or near it; in fact, there were no wires of any kind connected to or near the building. Street car line one block distant.

The writer tested around the gas meter, and found that it did not insulate the gas plumbing from the ground; the water plumbing was also grounded. A contact anywhere in the building between a gas pipe and a water pipe caused numerous sparks. Will some reader kindly tell us what caused the sparks?

Automatic Electric Lighting.

Electricity is the only form of artificial lighting which can be made automatic.

One of the simplest forms of automatic lighting is the tiny incandescent lamp in the dark clothes closet which lights every time the door is opened and goes out the instant it is closed. Too many houses have been burned to the ground because people were forced to carry lightd oil lamps, candles or even to strike matches to find something in a dark clothes closet. Usually clothes closets are filled with highly inflammable material, such as dresses and papers, and the flying head of a match, an overturned lamp or a candle carelessly held against a bit of cotton dressgoods instantly starts a fire which cannot be put out. The clothes closet should be equipped with an eight candle-power lamp and so connected that it automatically lights whenever the door is opened and goes out when it is closed. This is arranged by inserting a spring switch in the frame of the door, on the hinge side, in such a manner that when the door is opened it releases the spring plug and allows the lamp to light. Closing the door pushes back this plug and cuts out the light.

LETTER TO THE EDITOR.

Installation of Transformers Within Builings.

To the Editor:

In reading the quotations from P. H. Bartlett's paper in the November *Electrocraft* I was much interested by what the writer had to say relative to enclosures for transformers when these are to be installed inside a building. The practice of placing transformers within interiors has been rapidly growing in our territory, and we have found it desirable to require a very different type of transformer from that described by Mr. Bartlett. According to our requirements the transformer must be placed in a fireproof room having walls and ceiling made either of brick or reinforced concrete. The ventilation must be direct to the outside of the building, and there must be a raised sill and a tightly fitting safe-pattern door.

Several serious transformer and oil fires have recently confirmed us in the opinion that our requirements are entirely reasonable and just. We consider the metal construction described by Mr. Bartlett to be but little better than placing the transformer in the open room, so far as fire protection is concerned.

J. W. CANADA.

Denver, Colo.

(In order that our readers may better appreciate the above letter that portion of Mr. Bartlett's paper referring to the installation of transformers is reprinted below.—EDITOR.)

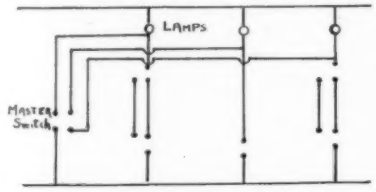
Inclosures for transformers inside buildings may be built of corrugated galvanized iron, of not less than No. 26 gauge, with an angle or channel iron framework. The door is constructed of the same material and is hinged and locked, and one or more fixed windows with metal frames and wire glass are used. One or more louvre ventilators are installed on the transformer side near the floor for air inlets, and one or more 12-inch to 16-inch ventilating pipes equipped with a hood and damper are placed in the roof. The size of these enclosures and the number of windows and ventilators required depend, of course, on the number and capacity of the transformers to be installed, but it is found advisable not to have the room much less than ten feet in height. The floors are of concrete and some inspection boards require drainage facilities to carry off any oil which may escape from the transformers. The service is terminated in an oil switch, and primary fuses are placed on each transformer, and fuses are also placed on each secondary lead, when two or more transformers are connected in parallel. The oil switch casing, primary fuse boxes, transformer cases and all iron work should be effectively grounded. The primary and secondary wiring and the fuses and supports should all be so arranged that any one transformer can be readily disconnected and drawn out without disturbing the others.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

A Convenient Method of Lamp Control.

I am much interested in the "dollar wiring kinks," and beg to submit the following simple method of controlling emergency lights. It has the advantage of requiring no extra wires at the outlets and is simple and inexpensive to install. Each master switch will control three lights or groups of lights on the same circuit. As seen by the sketch the lights may be controlled locally by either single-pole or three-point switches. The master switch is an ordinary four-point switch having the



Arrangement of Switches.

blades short-circuited by a pin or cross bar. Thus, when the switch is pushed "on" the four points of the switch are short-circuited, causing current to flow to the three outlets regardless of local switches. When switch is pushed "off" there is no contact between any of the points, and lights are operated by local switches individually.

C. C. Sisson.

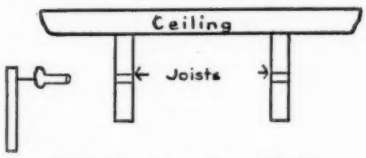
Locating Short-Circuits.

When a short circuit occurs in a lighting fixture, I have found the following method very convenient for locating exactly the source of the trouble. My method consists simply in substituting a thirty-two-candlepower lamp for one of the plug fuses in the cutout. It is desirable to use a lamp of this size because of its relatively great current capacity. As soon as this lamp has been inserted it will be found that all the lamps in good condition will burn with a dull red glow, while lamps on the fixture where the short circuit exists will not burn at all. The trouble may then be removed by disconnecting this particular fixture. I have tried this plan often during several years of wiring experience, and have never known it to fail.

Fred A. Jerram.

Installing Porcelain Tubes in Joists.

I have noticed wiremen who, while engaged in running circuits through overhead joists, proceed to place the porcelain tubes in the holes through the joists by climbing a step-ladder to do the job. Since this plan necessitates a frequent moving of the ladder from one place to another, the work necessarily proceeds rather slowly. I find that a great gain in speed in such a job as this may be made possible by using a tool made of a narrow, long strip of wood—from three to five feet long usually—with a twenty-penny nail



Method of Inserting Tubes.

driven through one end of it. By placing the porcelain tube on the nail it may be inserted in the joist from the floor. The character of the device is indicated in the accompanying figure.

A. S. Allen, Jr.

Pulling Wires Past Sharp Bends in Conduit.

I should like to be allowed to say that I find the "Wiring Kink" page very interesting, and also very helpful to me in my work. It occurred to me that the following account of a recent experience of mine might not be out of place there, since other wiremen are liable to encounter the same difficulty as that with which I had to contend.

Not long ago my company undertook to finish a conduit job a part of which had been completed by some wiremen who were either woefully lacking in experience with work of this kind, or else extremely careless about how they installed the conduit. There were so many sharp bends in the conduit that we often found it very difficult to pull a circuit in. So we used two steel tapes. On one of these we placed about two feet of cord and on the end of the other we made a good hook. Then we fished from both ends of the run of pipe and by this means were able to catch the piece of cord with the hook and pull one of the steel tapes through. This having been done, it was easy, of course, to pull in the wires.

E. F. Thomas.

A Handy Tool for Fishing Wires.

In fishing wires in between side walls the wireman sometimes encounters a piece of plaster or a piece of wood past which it may be difficult to carry the conductors. In cases of this sort I have found the tool described in the following note very useful. This appliance is made by taking a full length drill rod and boring a No. 30 hole in either end of it, and then flattening and filing one end till it has a sharp point. By threading the wire through these holes it can be easily carried past such obstructions as those mentioned. This tool may be put to good use in other ways, particularly in running circuits in close quarters.

C. A. Johnson.

Drilling Slate or Marble Switchboards.

In drilling holes in switchboards for the purpose of placing additional instruments on them, or for putting in lead and screws for additional wiring on the back of the board, I have found it best to use a small one-eighth-inch drill first and then to make the hole larger by following this with a one-quarter inch drill, and later with other drills of increasing sizes until the hole is made the proper size. In this way

Effect of Large Drill.

the drilling may be done much easier and faster than is possible when it is attempted to finish a hole with a single bit. Besides cutting very slowly the large drill tends to ream the hole at the sides and thus leave it bigger than is desired. The effects of this reaming are indicated in the figure. I have also found it a good plan to wet the drill points frequently during the boring process.

G. W. Goddard.

Reinforced-Concrete Telegraph Poles in New Zealand.

The Post and Telegraph Department of the New Zealand Government has begun to use reinforced-concrete telegraph poles on a large scale. For the circuit between Auckland and Hamilton 1,265 such poles are being placed. They have a height of 26 feet and dimensions of 6 by 8 inches at the base and 6 by 6 inches at the top; corner poles are longer and larger. The special process used in the construction makes the poles but slightly heavier than the tatara-wood poles formerly in general use.

Among the Supply Men

THE DIFFERENCE IN OPERATING EXPENSE AS APPLIED TO SHELF STOCKS AND WAREHOUSE STOCKS.

By T. C. Ringgold.

Considerable time would be required to tabulate details and arrange their presentation in a convincing and forcible style, in order to prove that a great difference in operating expense exists between the two methods of handling goods, and to show how the difference varies with the character of the merchandise.

It may be asked, "Why attempt to prove it at all?" It seems like making an effort to convince a man that twice two is four—in other words—it is a self-evident proposition, and not debatable, and the fact that this operating expense varies and travels from one extreme to another, and changes its complexion according to the character of the goods and the physical condition of the business, does not in any way invalidate the claim or decrease the importance of giving it grave thought and attention—rather it adds weight, on account of the illusive and deceptive features it presents.

I believe that all men who have thought on the subject along the right lines, and whose books are a true record of their business, fully agree with these statements; but that there are others who either disbelieve or haven't thought, or haven't investigated, is evident from the prices that are made by some on shipments of shelf stock, and in this I am not referring directly to heavy merchandise that is not usually purchased to supply a regular demand.

It is known that some jobbers, doing business up to perhaps $600,000 per annum, are deceiving themselves with the belief that because their overhead is low, they can turn around readily, and having none of the complications and expense of a larger business, think they can sell on a margin of less profit than that demanded by houses doing a greater business and with a corresponding overhead expense, and I presume that there will continue for all time a certain type of mentality that will insist upon thinking and acting along such lines, but they are so in the minority as to be the exception which proves the correctness of the rule, and they also in time will pay the price that experience invariably charges its pupils, especially those who ignore fundamental principles.

It would be of interest for many of you who have not by your records, or in person, traced a series of shipments in and out of your premises, to personally follow a few orders—you will find it wonderfully illuminating. It is telling an old, old story all over again, but let us take a concrete example—and this a case of schedule material—to illustrate the point.

This. as you know, is active stock, not breakable or easily damaged in handling. Let us imagine that you have just received two cases on the floor of your receiving department. One of these goes into warehouse stock. We follow it—first from the receiving department it is trucked to your warehouse and occupies about 2.5 square feet, until you receive an order for it. Again it is trucked to the shipping department, a tag nailed on the box, or a name painted, one shipping ticket, one invoice—or an item on one invoice—and the transaction is closed. There is no chance of a claim for error in counting, in packing or that the goods are shop worn, or that an error was made in billing. It is a clean cut transaction and your money is not held up and your profit wasted by a controversy.

Such a transaction, sold at 45 and 10 per cent, and if you earn 15 per cent rebate, leaves you a gross profit of about $12.00, providing your customer earns no rebate, but there are not many of these.

Now let us take up the other case. This must be trucked to your shelf stock room, the box opened, the goods removed and placed on a shelf—that means the lifting of twenty cartons—the cover renailed on the box and the box disposed of until wanted for shipping other goods. The goods and the box that contained them are now occupying about 5 feet instead of 2.5 feet, and warehouse space is costly.

There are men here who will prove to you by their own records that twenty shipments are required on the average to distribute 500 sockets from shelf stock—our records corroborate this. This means that the quantity will vary, but the average is twenty-five sockets to a shipment, referring only to less than case shipments on every one of these twenty shipments, of which these sockets may be a part or the whole. You have on the average twenty countings, by two or three men—also twenty opportunities for error in counting, in packing, in customers' misunderstanding, in pricing and billing. It means that twenty items have to be invoiced, which may require anywhere from five to twenty invoices, stamps, envelopes, addresses, all of which presents as many times the opportunity for loss of business on account of a dispute and twenty times the amount of work that is required to handle the single case, which is never opened by you. Your gross profit on all this might be about $21.00, or 40 cents per shipment over the other case, provided the customer does not earn a rebate. However, the most of said customers will earn at least 7.5 per cent rebate, and some more, which would bring it down to 35 cents per shipment, or less, out of which you must meet all the expense named before and then some.

No man here can honestly believe it is within the bounds of business possibility to handle twenty such shipments and accountings within this price. And this refers only, mind you, to clean decent stock, like sockets or similar goods, and where do you get off when you consider such goods as dry batteries, incandescent lamps, tape, knife switches, inclosed fuses and cutouts, lock nuts, bushings, outlet boxes, metal and porcelain shades, globes, and practically every other dollar's worth of stock sold by jobbers? Think of the mutilated and shop-worn goods of all classes that you junk every inventory, and you must also be aware of the loss from breakage that occurs in stock and that the warehouse men and boys throw into the rubbish.

Now let me refer you to the example set by other business institutions that have been in existence before an electrical jobbing house was created. Again such reference may seem superfluous, but it is by reiteration that one's mind is impressed.

If as a dealer you buy from a grocery jobber you cannot obtain two or three bars of soap within ten per cent of the full-case price. If you buy a gross of socks one day from a dry-goods jobber you cannot the next day

obtain a dozen at the gross price or within ten per cent of it. A dealer can buy a gross of collars at about 85 cents to a dollar per dozen, but a single dozen will cost him $1.50 and one collar at the rate of $1.80 per dozen.

Teach yourself a lesson by getting prices on a barrel of glass tumblers and then on a single dozen taken from a shelf, or any article similar to this, even of a less fragile nature.

You cannot purchase a quart of turpentine or oil within ten per cent of the five-gallon-can price per gallon, although you may call for the goods and bring your own can.

A hardware jobber will not sell you less than a gross or even two or three gross of screws at a price within ten per cent of the case-lot price—the difference will be nearly 80 to 100 per cent. And to sum it all up briefly you cannot obtain from any manufacturer or jobber (except a very few who make special lines) miscellaneous lots of goods from shelf stock at prices within ten per cent of the case or full-quantity price.

Forgetting shelf stock for a moment and considering heavier merchandise, the necessity for a longer price for small quantities is fully as great and in many instances even greater on account of the bulky nature of the goods and the fact that more than one man is required to handle the reels, barrels or coils. On this class of material the cost of handling varies somewhat from that of shelf stock for the reason that heavier merchandise is just about as expensive to handle in small quantities with a larger order as it is when shipment is made separately and without being included with other goods. Take for instance less than full quantities of such material as galvanized strand, Greenfield conduit, outer arc globes and all other heavy or fragile merchandise that is fairly represented by the above. The cost of handling each item of such material is fixed, regardless of whether it is a single order by itself or part of an order for a quantity of other material. For instance, it costs just about as much to measure off and handle ten feet of Greenfield conduit, galvanized strand or non-metallic conduit as it would cost to cut off and measure and handle 225 feet, and unless such material had to be specially boxed, the cost of handling would be precisely the same if ordered by itself or in connection with other material. Therefore it is imperative that we obtain a sufficient price for such broken quantities as to offset the cost of handling the items either separately or collectively.

It must be admitted that these are facts, and in view of them, how can you expect to successfully conduct your business on a different plan? Of course, if you take the ground that you are a better business man than the manufacturers or the jobbers in other lines, or that you can afford to offer more than you get, or to give what you do not receive and without extra pay, why then this may not appeal to you as a sound argument or a statement of fact, but believe me, it is only a matter of time before a flash of intelligence will illuminate the situation for you and the spark that kindles that flash will be struck from an empty exchequer.

The homely examples that I have mentioned have been quoted in order to refresh your mind with the fact that every manufacturer, distributer and retailer throughout this country, except electrical jobbers, have long ago discovered that the profit on goods sold in full packages is absolutely absorbed by the reduced profit and loss incurred in the handling of goods in less than case quantities, unless a price considerably in advance of the case-lot price is charged, and this demands that the advance should be anywhere from 10 to 200 per cent, the majority from 40 to 200 per cent. If you doubt this in any way, there are a dozen men, whose success and experience make them authorities, who will be glad to take the time to present to you irrefutable arguments and records beyond question, that will prove to you beyond a shadow of a doubt the absolute truth and correctness of these statements, and I would suggest that if you have doubts that you challenge these men now and get full benefit from the light of their experience.

None of this should be taken to mean that the price of staple merchandise should be increased to any figure that would be restrictive of business or beyond a point necessary to cover the absolute handling in small quantities and from the shelf, nor does it mean that we will not have to distribute certain lines of staples at a loss—and let me point out that this loss has a deciding influence on the amount of profit that must be obtained from other lines to bring up the average.

What I have said is intended to prove without statistics that the cost of operating expense as applied to shelf and warehouse stock is greater than the majority of us have believed, and that no phase of our business presents such a crying need for attention and readjustment, and such adjustment can only be made by analysis of our costs of operating. This analysis will show that the need for obtaining a profit on all such orders is greater now than ever before.

You are all aware of the increased selling cost and that profits are not obtainable in proportion. There is not a man in the electrical jobbing business that can afford to treat this matter lightly, or to ignore it in any degree, and those of us who have analyzed and have figured and have proofs taken from actual operation, will be very glad indeed to individually or collectively bend every effort toward enlightening those who have not given the matter thought, or who have any doubts of the facts.

Just a few additional words. This is an age that demands progressive effort and the broadest minded intelligence, unmixed with selfishness. The man who decides that, as his is a one or two-man business he need not concern himself with such matters, is a menace to his own success, for he is an obstructionist to the progress of the entire electrical jobbing business, of which he is a part. If he wishes a fair profit on his investment of money and time he must do his part in the riveting together of the entire structure so that it may stand out as a monument to the intelligence and foresight of the builders.

Supply Men and Their Interests.

Oscar Turner, of the Southern Wesco Supply Company, Birmingham, Ala., is one of the men of wide acquaintance in the electrical field. His company is one of the biggest organizations of its kind in the South and its field of operations covers a great territory. Mr. Turner is an enthusiastic Jovian and was Eighth Jupiter during the reign of 1909-1910.

The Holabird-Reynolds Company, San Francisco, Cal., covers the Pacific Coast with its organization. The company has branch houses at Los Angeles and Seattle. Ross D. Holabird, the active head of this organization, is not only a salesman of national reputation but he is a champion golfer and is always among the high men in the contests at the supply men's convention.

E. C. Graham, of the National Electrical Supply Company, Washington, D. C., is a prominent figure in supply circles. The company is doing a thriving business in the capitol city and reports the outlook for business tip-top for the coming year.

Few men in the supply business, and in fact in the entire electrical field, are better known than W. E. Robertson, of the Robertson Cataract Company, Buffalo, N. Y. Mr. Robertson is an active exponent of enterprise in the merchandising of electrical material. He has taken a leading part in the building up of the civic and industrial developments of Buffalo, is an honored member of many business and civic commissions, and to his energy and intelligence are due much of the industrial growth that has come to his home city within recent years.

Public Service Commissions

WISCONSIN.

The Commission has dismissed the matter of the Juneau Electric Company vs. the New Lisbon Mutual Telephone Company with an order requiring both parties to co-operate so as to remedy the effects complained of by the former company. From the testimony at the hearing and from the subsequent investigation by the engineering staff, the Commission held that both parties were to blame. Whether from malice, as was alleged, or through ignorance of proper methods of construction, it appears that the defendant company has so constructed its telephone lines as to seriously interfere with the service of the petitioner as well as to handicap its own service. Furthermore, the dilapidated condition of the defendant's wire plant materially increased the difficulty. The Commission ordered the plaintiff to rehabilitate its system and the defendant to reconstruct its telephone lines where the proximity of the two systems would make such reconstruction necessary. In the matter of the petitioner's application for an increase in rates, the Commission followed its established policy and refused to consider the application until the company has its system in first-class shape and in position to render adequate service.

After an investigation of the proposed plans and expenditures of the Battle Island Company, the Commission has approved an issue of $100,000 par value of stock by the corporation. The certificate specifies that the issue is authorized for the purpose of enabling the company to acquire a site for a dam and 3,500 acres of flowage land on the Wisconsin River, near Knowlton, in Marathon County, and to pay the organization and engineering expenses. The total capitalization of the company is to be $645,000. It is the intention to develop approximately 2,500 electrical horsepower and to build a 72-mile transmission line to the city of Neenah. The cities of Oshkosh and Fond du Lac may later be added to the system.

The application of the Wausau Street Railway Company for authority to issue $350,000 par value of five-per-cent bonds has been approved by the Commission. The mortgage or trust deed is to be issued to the Wisconsin Valley Trust Company, of Wausau, as trustee. The Commission specifies that the bonds are to be issued for definite purposes.

The Commission has served notice upon the Southern Wisconsin Railway Company that it will immediately proceed to investigate its rules, service and regulations. This action followed the receipt of several complaints alleging that the service of the Railway Company in the city of Madison is unsatisfactory; that sufficient cars are not operated to adequately handle the traffic; that the cars are often overcrowded and that insufficient ventilation causes an unsanitary and unhealthy condition to prevail; that the rules and regulations of the company in connection with the manner of operating cars and handling the traffic are unreasonable and oppressive.

The Commission has fixed January 20 as the date for hearing the application of the Chicago and Wisconsin Valley Railroad Company for a certificate of public convenience and necessity relative to the construction and operation of a line of electric railway to extend from Madison to Portage.

To enable it to secure the property and equipment of the electric and heating departments of the Mineral Point Electric Light Company, the Commission has authorized the Mineral Public Service Company to issue $23,000 par value of stock and $42,000 of five-per cent bonds and to exchange the same for the aforementioned property. The Commission further authorized the company to issue $127,000 of capital stock and $75,000 of five-per-cent bonds in addition, for the purpose of enabling the company to acquire the necessary real estate and to reconstruct the plant of the Mineral Point Electric Light Company; to purchase and install the necessary equipment and to erect transmission lines.

The preliminary hearing has been held by the Commission in the test case brought by the Bell Telephone Company to test the law passed by the last Legislature providing for the physical connection between telephone systems, and the Commission's jurisdiction in the administration of the law. The case involves the application of Frank Winter of La Crosse for the physical connection of the La Crosse Telephone Company and the Bell Company.

MARYLAND.

In its recent order ratifying the sale of the capital stock of the Western Maryland Telephone Company to the Chesapeake & Potomac Telephone Company, the Commission laid down the principle that the controlling consideration in determining the advisability of such a merger must always be the general advantage of the public. Although the independent company operated 2,800 stations, compared with 800 stations operated by the Bell company, the former were so bottled up by lines of the latter that even those most interested in the independent company were obliged to have Bell telephones installed in order to communicate with outside points.

The Commission has secured from the Telephone Improvement Company of Washington, D. C., an exhibit of two types of meters for indicating and recording the amount of use of a telephone station, and it desires the telephone-using public to inspect and observe them in operation. The first type of meter is intended to register the number of calls or messages which are sent from the calling subscriber's telephone; the operation is automatic, no additional burden being put upon either subscriber or operator. The number of messages is recorded on a dial. The second meter is arranged to register the time during which the telephone is in use, the indication being shown by a dial.

MASSACHUSETTS.

The Boston Elevated Railway Company has been authorized by the State Railroad Commission to act as a common carrier of baggage and freight in Boston, despite the City Council's refusal to grant the right.

With regard to the announced reduction from 5 to 3 cents in the charge made by the New England Telephone Company for excess calls within the eight-mile radius of the subscriber's exchange, the Massachusetts Highway Commission gave out a statement in part as follows: "Prof. Jackson reports that there have been large numbers of new subscribers under the new schedule of rates, something over 14,000 having come in within the year. Consequently the commission recommended to the company, with the approval of its experts, that this reduc-

tion in this rate should be made, and the company accepted the recommendation, the reduction to go into effect the first of the year. There are approximately 37,000 subscribers in the metropolitan and suburban district who have elected to take this district measured service, and this seems to conclusively demonstrate its popularity. Broadly speaking, the results of this reduction for excess calls makes only three classes of so-called zones—the measured-service rate covering all exchanges in the metropolitan district, the measured-service rate covering all metropolitan exchanges within a radius of eight miles of the calling exchange, and the district rate for each exchange district, for which either flat or measured service may be elected."

OKLAHOMA.

Quoting the recent decision of the Supreme Court in the case of the Shawnee Gas and Electric Company, to the effect that the Corporation Commission had authority to fix rates to be charged for gas or electricity, the Commission has issued an order in complaint of the Oklahoma Lead and Zinc Mining Company, of Miami, requiring the gas company at that place to make the same rate for gas used in gas engine as when used under a steam boiler. The company charged 15 cents per thousand cubic feet in the latter case and 30 cents in the former. The mining company claimed that this constituted discrimination and the commission took the same view.

OHIO.

A legal opinion was recently handed down by the Circuit Court which is of general interest to public-utility corporations throughout the state of Ohio. The decision is in the case of the Tiffin Art Metal Company, against the Tiffin Consolidated Telephone Company, and interprets the meaning of the new Public Service Act passed by the last session of the Ohio Legislature. On October 4 the City Council of Tiffin passed an ordinance decreasing telephone rates. The ordinance was ignored by the defendant and an injunction suit was brought to prevent the collection of rates higher than those fixed by the Council. The injunction was granted by Judge Duncan of the Common Pleas Court and the Telephone Company appealed to the Public Service Commission. The Commission required a bond of $30,000 to rebate patrons of the company in event of a ratification of the Council's action. In the meantime the Circuit Court on appeal dissolved the injunction, holding that the authority of municipal corporations does not extend to fixing rates, under the Public Service Act.

NEW YORK.

The Appellate Division of the Supreme Court has dismissed the appeal of the Public Service Commission from an order to review the action of the Commission in granting the Long Acre Electric Light & Power Company a certificate of public necessity and convenience. The New York Edison Company holds that since the State has undertaken to regulate the terms and charges for supplying electric current the authorities should protect it from competition. When the petition of the Long Acre Company was approved by the Commission the matter was taken into court and by this decision must be determined there.

For more than a year the Commission has attempted to effect an arrangement for the opening of the Steinway Tunnel to Long Island but the directors of the old New York & Long Island Railroad Company have refused to enter into any negotiations. The Attorney General has now begun suit at the instance of the Commission to declare forfeited the franchise of the company. In 1909 the State brought action against the trustees of the company and the court then ruled that as the franchise was granted by the State it was the State which should apply for its cancellation.

The Commission will be asked to prohibit the issuance of bonds to construct the municipal plant in the city of Binghamton, which was authorized at the annual election. This will be based on the grounds that the city has a central station which is already giving satisfactory service. The policy of the Commission is preventing the duplication of plants, but no precedent exists of a case in which a municipal plant has been opposed by an existing company.

Within a few days of the first of the year a number of corporations have applied to the Public Service Commission, Second District, for authority to issue securities with the proceeds of which to reimburse their treasuries for money expended for fixed amounts from net income in the past. The total of the applications in this class filed during the last week was $19,205,345.26.

These expenditures from income in some cases extend back into the 80's, and the cause of the large influx of such applications at this time is that after January 1, 1912, securities may only be authorized by the Commission to reimburse the treasuries of corporations subject to the stock and bond provisions of the Public Service Commissions Law during the five years next preceding the date of the application. This provision of the law was inserted by an amendment passed by the legislature of 1910. Prior to that time the Commission was only permitted to authorize securities for four purposes: (1.) Acquisition of property. (2.) Construction, completion and extension or improvement of its facilities. (3.) Improvement or maintenance of its service. (4.) Discharge or lawful refunding of its obligations.

This meant that if a corporation invested its surplus earnings over fixed charges in fixed assets it could not later reimburse its treasury on account of such expenditures and as a result the managers of many corporations were impelled, not knowing what the future would bring forth, to capitalize by the issuance of stocks and bonds, every dollar expended on their properties, even though they did not believe such a practice to be in accord with a conservative financial policy.

To do away with this necessity, the law was amended in 1910 and up to the first of the year, corporations might have included in their applications expenditures from income as far back as they saw fit, and from now on may ask to be reimbursed for expenditures during the preceding five years. As to the applications covering a period prior to 1907, it is left to the discretion of the Commission as to whether its consent should be granted.

During the year just closed, the Commission authorized securities for the corporations under its jurisdiction amounting to $162,581,718.52, divided among the classes of corporations as follows:

Steam railroads, $119,718,937.52.

Electric railroads, $24,323,500.

Gas and electric companies, $17,952,-581.

Telephone companies, $581,700.

The Public Service Commission, Second District, has received a complaint transmitted by F. C. Perkins from purchasers of electricity in the city of Buffalo, against the Buffalo General Electric Company, the Cataract Power & Conduit Company, and the Niagara Falls Power Company, regarding electricity produced and sold by these companies. The complaint states that the prices charged by the Niagara Falls Power Company to the Cataract Power & Conduit Company affect the prices charged by the latter company which sells electric power to the Buffalo General Electric Company, and that as a result of these relations existing between the three companies, the charges made to consumers in the city of Buffalo, and to the municipality itself, are unreasonable. The petition requests an investigation into the relations between the three companies, the methods employed and the prices charged customers in Buffalo, to the end that such prices may be fixed to correspond with the cost of producing, transmitting and distributing electricity in Buffalo for light, heat and power.

VERMONT.

In the petition of the Orange County Telephone Company vs. Royalton Power Company and Rapid Telephone & Telegraph Company, which complained that unsafe conditions existed between the villages of Chelsea and South Royalton, with respect to the location of telephone and high-voltage electric wires, a hearing was held at South Royalton on November 8, after which the Commission employed an electrical expert to make a careful examination of the conditions and report his findings and recommendations. This was done, and on December 4 the Commission issued an order in which certain findings were made: that for some years there has been located along the highway between the villages of Chelsea and South Royalton, separate telephone lines of the two companies; that the poles and wires are in some places on the same side of the highway, and in other places on opposite sides; that the Royalton Power Company is constructing along the highway a line of poles to carry electric current of high voltage to be used for power and electric lighting; and that the three lines will greatly interfere with each other and with the public safety and proper service. The Royalton Power Company is ordered to so construct its lines that they shall in no case parallel the lines of either of the telephone companies at a distance of less than fifteen feet from the nearest wires, and where such a condition already exists, the Power Company is ordered to move the wires of the Orange County Company, to the poles of the Rapid Company, and certain provisions are made as to the proportion which each Company shall bear of the expense. The Power Company is ordered to have a high-voltage insulator in series with all guy wires and installed approximately four feet from its attachment to the pole. Where the wires of the Power Company cross the wires of the Telephone Companies, specified construction shall be used.

Attention is also called to the fact that the distribution system of the Power Company in the village of Chelsea is in need of a general overhauling in order to eliminate many dangerous conditions, where power wires are in contact with telephone wires, and also where there is great liability of serious crossing in case of storms. These conditions, it is understood, are to be eliminated without a special order on the part of the Commission.

Throughout this territory wherever the high-potential line of the power company is involved, in future construction and renewals of poles the telephone companies are asked to endeavor to place their poles and wires on the same side of the highway, so as to make a minimum number of crossings with the power line, and to that end the two telephone companies should use the same line of poles, as far as possible, on some agreed rental basis.

NEW JERSEY.

The Board of Public Utility Commissioners of New Jersey has made its yearly report to the Governor. In the introductory portion of this report, attention is called to the enlarged scope of the work occasioned by the passage during the year 1911 of the Public Utilities Act. Doubts that were previously entertained as to the powers of the Board and of the previous law have been largely removed and no question now exists of its power to determine rates. This power is being exercised in a variety of ways covering railways, gas companies, electric companies and telephone service.

With regard to existing rates which appear to constitute discriminations, the Board has adopted a definite policy that the continuance of such rates which have had the sanction of custom, and where they are presumably of assistance in assisting education, the administration of charities, etc., will not be regarded as conflicting with the statute, unless in a specific case the hearing develops some definite evidence of discrimination. The Board has also announced that it does not regard the free transportation of policemen, firemen, health inspectors, etc., as a violation of the provisions of the act. It is also permissible to grant special rates to members of the National Guard and federal letter carriers.

An investigation is under way with respect to the charges for electric service. As many of the larger municipalities are served by one company the Board is attempting to make a comprehensive inquiry in this direction.

A State-wide investigation of telephone rates is being made. This resulted from the complaint arising in Camden, N. J., against the rates of the Delaware and Atlantic Telegraph and Telephone Company. As the company operates over 30,000 stations in the western and southern portions of the State it asked that the investigation be made State-wide. The hearing on this matter will therefore be an extended one, involving the fundamentals of telephone rates.

A wide investigation covering the supply of illuminating gas for a large portion of the State has also been instituted, the Passaic district being the first to be considered in detail.

The electrical inspector has visited the plants of nearly all the electric lighting companies of the State and examined the standards in use and the methods of testing meters. A majority of the companies were found to be equipped with considerable apparatus for testing but had no means of checking their own standards. To provide for this the Board has equipped an electrical laboratory in one of the buildings of Rutgers College.

Methods of uniform accounting have been considered by the Board under its power to require accounts that will afford an intelligent understanding of the conduct of the business. While a uniform system of accounting had been prepared for all gas and electric companies, it was found impracticable to put this in operation at once, and consequently it will not become operative until January 1, 1913. A conference committee consisting of representatives of the various companies and the Board's chief inspector and accountant has been appointed and is to report before April 1. Steps are on foot to secure definite systems of accounting also for water, sewer, telephone and railway companies.

Any franchise or privilege granted to a public utility is not valid until approved by the Board. The examination of franchises has required a large amount of time.

Dealing with the securities which must be approved by the Board before issue, attention is called to the law which provides that bonds be issued only in return for cash or property of a value not less than eighty per cent of the face value of the securities. The Board believes that this authorization of issuing bonds at eighty should be discontinued. It recommends that public utilities shall be required to provide out of their earnings for the amortization of the discount at which such bonds have been issued or sold. It also recommends that the Board should be empowered, after hearing, to direct any public utility to establish and maintain just and reasonable connections, which power already exists as regards railroads. It is especially desirable in the case of telephone lines. The indeterminate franchise is recommended to be compulsory for all new public utilities. Many other points are taken up in the report which cannot be mentioned here.

Public Service Commission in Manitoba.

Premier Roblin of Manitoba has announced the organization of a public Service Commission, to be vested with judicial, administrative, appellate and directory authority. The commission is to have charge of steam and electric railways, gas and electric lighting, telegraphs, telephones, grain elevators and any other utility that gives public service.

PROTECTION OF HIGH-TENSION POWER CIRCUITS AND APPARATUS.

Paper by James Lyman Discussed at Joint Electrical Meeting in Chicago.

At the joint meeting held on December 27 by the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers, James Lyman presented a paper on the "Protection of High-Tension Power Circuits and Apparatus." An abstract of this paper follows:

Protection of High-Tension Circuits.

The present general practice in this country provides for automatically opening the oil switches or circuit-breakers at the power-house end of all feeders, not instantly but after a sufficient interval of time has elapsed to permit any momentary surge or overload currents to pass away. The relays performing this function are usually of the inverse-time-limit overload type. They are generally set to open the switch after two seconds with about twice the normal carrying capacity of the cables or lines. Under a heavier current—for instance, a dead short-circuit—they would operate in a fraction of a second, or at a speed inversely proportional to the overload. In some cases, however, as when several substations are connected in series, a definite-time-limit overload relay is used. The bus or buses supplying the feeders must be maintained alive under all conditions of operation, even at the risk of the generators, and, therefore, the oil switches connecting the generators to the bus or buses are not usually automatic but are hand-operated. Any generator in trouble can usually be cut out of service by the switchboard operator without injury to other generators operating in parallel with it and without interruption to the service, because an appreciable time is generally taken after a fault first starts to completely break down the insulation of the generator windings.

Where step-up transformers are installed in the power house, either inverse-time-limit overload relays or reverse-current relays are used. Motor-generators, rotaries, frequency changers, etc., in the power house and substation are usually connected to the alternating-current buses through automatic oil switches controlled by inverse-time-limit overload relays and to the direct-current buses through reverse-current relays. All light and power feeders from the substation are also provided with these automatic oil switches, the relays being set to protect the load they supply usually at twice their maximum load.

The excellent service rendered by practically all the large electric companies operating under the above general conditions would make it appear unnecessary to provide further protection. Occasionally, however, interruptions in service are unavoidable and are sometimes followed by serious damage to apparatus.

The ideal relay and switch combination would be that which would instantly cut off a feeder suffering any defect. This ideal today is only realized in such systems as railway systems where the circuit-breakers can be set to trip instantly; and they do so no matter whether the actuating impulse results from a sudden-load swing or a short-circuit. In power distribution from a generating station to substations or to general distribution systems, of course similar methods are impracticable because a relay designed to operate instantaneously gives, with its oil switch, a time element approximating one-quarter of a second for the solenoid type of oil switch, and one-half of a second for the motor type of oil switch. The major portion of this time is consumed by the mechanism of the switch itself. In other words, instantaneous relays cannot be made successfully selective. This type of relay also cannot be made to distinguish between a swing lasting two or three cycles, as at time of synchronizing, and a short-circuit lasting indefinitely; that is, the relay cannot discriminate.

To make the automatic device selective, the inverse type of relay and the reverse-current type of relay were developed. The inverse-time-limit relay has a time element whose action is quicker the larger the overcurrent flowing, in approximately inverse ratio. This makes the automatics controlling the defective piece of apparatus more or less selective, and to a degree discriminating. They must be set to operate only on an abnormal and generally a dangerous overload. Therefore, a fault must develop to a degree dangerous to other cables or apparatus before the relay begins to act; and even under a dead short-circuit to ground or to adjacent conductors the relay cannot operate the oil switch instantly, but requires, say, one second of time. The time element of the oil switch, moreover, is from 0.2 to 0.6 of a second. It generally happens in such cases that the oil switches of other feeders operating in parallel are also opened, shutting down the substation and all its apparatus. For this reason some of the largest companies do not operate the feeders to a given substation in parallel, but they operate them radially, each feeder supplying current through a sectional bus to one or more rotaries or other units. The Commonwealth Edison Company, while adhering to radial operation of feeders, has, on its twenty-five-cycle feeders, applied a little poppet safety valve to the air dashpot of the inverse-time-limit overload relay which permits intantaneous operation of the relay when the current reaches 300 per cent of continuous carrying capacity of the cable. This is, in a way, objectionable, as the oil switch may have to interrupt an enormous intanstaneous flow of energy in the case of large generator capacity behind the feeder, and not only must the oil switch be capable of performing this operation, but the interruption itself may cause abnormal potential strains on the whole system.

The New York Edison Company, with 6,600 volts, twenty-five cycles, operates all feeders radial with ungrounded neutral, the oil switches at the power house and substations being protected by inverse-time-limit overload relays. All feeders are underground cables. At the power house each feeder is provided with a fault detector, which consists of a suitable coil slipped over the lead-covered cable and is affected by any capacity current that might flow in the lead sheathing. Normally the capacity between each conductor and the other two conductors, and between it and the earth, are relatively the same. Therefore, under normal operating conditions no capacity current flows in the lead sheathing of any of the feeders. If, however, a ground or a short between any two conductors occurs, the electrostatic equilibrium will be disturbed. Assume that a ground develops on one conductor of any feeder;—the capacity of this particular phase of the whole system to ground becomes zero, while the lead sheathing of all the feeders acts as a return circuit to the fault for the capacity current due to the electrostatic capacity of each of the other two conductors to ground. The detectors are adjusted to ring an alarm and operate an annunciator showing the number of the feeder affected. The switchboard operator can generally cut out the feeder at the power-house end, and telephone the substation operator to cut it off at that end before serious trouble develops. These fault-detectors do not operate the switches and cannot be used on a system with grounded neutral. They are best adapted for a large system having considerable capacity. The electrostatic equilibrium is sometimes unbalanced from some external cause, resulting in operating the alarm. This is easily determined by testing the cable after it is cut out of service. These fault-detectors have been installed on all feeders at the power-house end for more than two years and are operating satisfactorily.

The advantages of a relay that can discriminate between a fault and an overload, and that can cut out a faulty circuit or piece of apparatus before it has developed a serious power flow, are evident. The Merz-Price protective gear, named after its inventors, performs these functions. Any feeder or apparatus protected by it is promptly cut out of circuit simultaneously at each end, generally before the power flow becomes abnormal, while it is not affected by any healthy overload of power flowing in either direction. In other words, it protects the apparatus and the continuity of service against faults of all kinds, but not against overloads. As practically all interruptions to service and damage to apparatus are due to faults and not to temporary overloads, the Merz-Price protective gear offers the protection desired in heavy power circuits.

The system is based on the principle that while normally the amount of current leaving a conductor at one end is equal to that entering at the other, as soon as a fault or leak develops this equality disappears. By inserting current transformers at both ends of each conductor of the cables, and connecting their secondaries in opposition by means of pilot wires with relays in circuit, it is made possible, when, due to a fault, the balance between the two sets of current transformers is upset, and, in consequence, a current flows through the pilot wire, to trip the switches at both ends of the cable. In this way, as a fault affects only the particular pair of current transformers on either side and immediately adjacent to it, causing a current to flow along the pilot wire connecting these transformers, the faulty section is iso-

lated without disturbing any other. There are several ways of creating this balance of opposed forces applicable to various sets of conditions, but the principle remains the same in all.

With this system it is possible to obtain the full advantages of a duplicate supply, because the whole network may be kept continuously alive in the assurance that a faulty cable or other piece of apparatus will be isolated without in any way affecting the healthy duplicate, which will be thus left intact and automatically takes the load without even momentary cessation of supply. No matter how much current flows through a healthy section—i. e., a section in which there is no fault—the balance in the pilot-wire circuit controlling such section will not be affected. It should be noted that in addition to securing perfect discrimination between the cut-outs by adopting this system of protection, great economy in feeders has resulted, as it has been possible to adopt the principle of the ring main in place of the radial system of feeders which would otherwise have had to have been used.

In order that the relay may not trip out on transient swings, it is obvious that a period of about one-half to one second is the shortest time interval that can be hoped for in either the definite or inverse-time-limit overload relays.

The Merz-Price relay is not affected by transient swings, so that a speed of action impossible with the others may be obtained. The only theoretical limitations appear to be the speed of propagation through the pilot cable, and the best speed obtainable for the switch and relay to operate after the relay has received its impulse.

It will be readiy seen that the electromotive-force balancing is most applicable to the protection of feeders while magnetic balancing is best suited to the protection of transformers and other station apparatus.

When magnetic balancing is employed for protecting apparatus, the switchboard instruments can be included in the current-transformer circuits, avoiding the necessity of an extra set of transformers. The current transformers used must, however, be of ample current-carrying capacity so as not to heat under heavy overloads. The success of the Merz-Price protective gear depends on the absolute reliability of the current transformers. A higher insulation factor, is, therefore, recommended than is general practice in this country. The transformers should be tested to a voltage five to six times the working potential.

The cost for the protection is little, if any, more than for the reverse-current relays now used. Such relays, while very effective in selective action when the power flow is reversed under normal load conditions, may fail to act properly under extreme overload or short-circuit conditions. The reverse-current relay has a potential coil and a current coil. Under normal load conditions the magnetomotive forces of the two coils are opposed and balance one another. In case a fault develops in one of the windings of the large transformers, and current rushes in from both ends of windings, the potential coil aids instead of opposes, and the relay works, opening the oil switches at both ends. On short-circuit the voltage and the power factor may be very low, resulting in greatly reducing the effect of the potential coil, and the relay becomes simply an overload relay with uncertain action.

The Merz-Price protective gear is better adapted than the reverse-current relay for the protection of alternating-current apparatus such as large transformers and generators. By proper design of the current transformers and the relays used in connection with them, suitable voltages can be obtained in their secondaries for reliable operation over many miles, using a three-conductor pilot cable of No. 10 or No. 12 B. & S. conductor. This pilot cable is the one objection to the Merz-Price protective gear. It costs laid, not including ducts, from $800 to $1,000 per mile. Where a number of feeders run to the same substation, the pilot-cable for each can be carried in a single duct. In most large central-station plants one or more spare ducts are available. The cost of the special current transformers at each end of cable and the relays for operating the switches at each end, is very moderate compared to the investment of the heavy cables and the value of the power delivered. Indeed, the saving in line losses and the increased reserve capacity of the feeders when operated in parallel instead of radially, in many instances largely compensates for the first cost of pilot cable and current transformers. Frequently, one or more spare cables are run from power house to substation for emergency use only. These could be dispensed with, or, if already installed, they could be always in service in parallel with the other cables with a proportionate reduction in line losses. In radial operation, each feeder and the apparatus to which it is connected may be considered a unit. Normally, when the apparatus is not in service the feeder also is idle. In cases of trouble in the feeders or the apparatus, the healthy feeders can be connected through transfer buses to almost any apparatus, and if necessary the feeders can temporarily be run in parallel, but the large companies normally operate the feeders to the substation radially. The increase in reserve capacity by multiple operation over radial operation, depends upon the capacities and arrangement of substation units as compared with the capacity of the cables; it will probably run from 5 to 15 per cent.

A further reduction in line loss and an increase in reserve feeder capacity can be frequently effected by tie lines between substations, these protected by the Merz-Price balanced-voltage gear. Where a number of substations require less than the increased capacity of a single feeder they may be ring connected; each section of feeder being protected, continuity of service is provided and any section may open without interrupting the service.

The considerable expense of the pilot cable will probably limit the use of the Merz-Price protective gear to heavy power circuits from power house to substations; also for tie lines between power houses and tie lines between substations, and especially where several substations are supplied with power from the same feeder or feeders in ring connection. The writer also believes it a desirable protection for large trip generators and large banks of transformers. He recommends the use of overload relays of the inverse-time-limit type on outgoing feeders from power house to substations and on light and power circuits of substation apparatus.

The balanced voltage gear for cable protection requires periodic inspection to insure its being in operative condition, as it is of the open-circuit type. The magnetic balanced gear for the protection of apparatus does not require the same inspection, as it is of the closed-circuit type.

The Merz-Price protective gear has been in successful operation in England for more than two years. The principal installation is on the Northeast Coast Power Company's system in the vicinity of New Castle. Here seventeen steam-turbine power stations, having a generator rating aggregating 120,000 kilowatts, supply power to more than 150 substations. All lines and cables are operated in parallel, through transformers where necessary, protected by the Merz-Price balanced-voltage gear, while some of the larger turbo-generators are protected by the magnetic balance gear. More than 1,000 sets of protective gear are in operation and give perfect protection and uninterrupted service. In this connection the ironclad switchgear designed by Merz and Price, and quite generally used in the power houses and substations of the Northeast Coast Power Company, is of interest. The switchgear is used on voltages up to 20,000 volts. It occupies considerably less space, is quite fireproof, requires practically no cleaning, and is "foolproof." Oil switches are used similar in design to our standard types and arranged so that they cannot be touched or even withdrawn for inspection or cleaning until the circuit is broken. In this gear the designers have entirely abandoned the use of slate or marble panels or bare conductors of any kind, and substituted a metal framework and box, in which all conductors are encased, the terminals being fixed in porcelain. The cables enter by ironclad trifurcating boxes fixed underneath the gear at the back, and inside of which are fitted the current transformers. The actual oil switch is mounted on a carriage running on steel rails or brackets at the side, so that it can be withdrawn for examination, complete with its operating gear, oil tank, etc. This breaks contact on two knife edges, the live contacts being at once automatically covered by two cast-iron flaps. It is impossible to break contact, however, until the main oil-break switch has been opened, and impossible to close the oil-break switch until the switch has been replaced in position in the contacts. The ironclad switchgear has much to recommend it, especially for substation use, in small towns where inexperienced men may be employed, space reduced, and probably a considerable saving in first cost obtained over our present standard practice.

The discussion was opened by R. F. Schuchardt, who called attention to the fact that the oil switch is the real element in the system that must take care of all troubles. It cannot be made to act instantaneously, and it is doubtful whether it should do so, because this would produce a surge and disturbance in the system. Several years ago the poppet valve was put on relays to make

them more reliable. It was not selective, however. Selective relays are now being developed. The Commonwealth Edison Company has over 500 miles of underground transmission line, over sixty per cent of which consists of 250,000-circular-mil cable. The Merz-Price system is an excellent one, but is not a cure-all for the troubles in a large power network. It is completely selective and cuts out a fault before it develops to large proportions. Oil switches can be designed to handle most cable breakdowns. The chief disadvantage of the English system is the high cost of the pilot wires that are required. Another difficulty is that it gets away from the growing tendency toward simplicity of apparatus; entire dependence is placed on a multiplicity of equipment. Moreover, the switchgear and busbars are entirely unprotected. Mr. Schuchardt thought that the greater freedom of the European systems from disturbances was due to the higher grade of cables that are available there rather than to more perfect protective devices. He felt that there is still needed a truly selective reverse-current relay. This seems now to have been developed, although not yet tried out. The Merz-Price system need be used with but one or a few of a set of feeders to a substation.

P. Junkersfeld described the development of American protective apparatus within the last fifteen years. At first dependence was placed on fuses on the low-tension side; then anti-explosion fuse blocks were developed for the high-tension side. Later the oil switch in conjunction with instantaneous relays was developed. This type of relay was followed by the definite-time-limit relay. Next came bellows relays, reverse-current relays and inverse-time-limit relays. The speaker described at some length the supply system of the Northeast Coast Power Company, which he had visited and in which Messrs. Merz and Price had ingeniously solved a multitude of very intricate problems. For that network the pilot system of protection was peculiarly appropriate. The ironclad type of switchgear has made decided headway. It is generally applicable in this country and doubtless will be used here within a few years.

F. F. Fowle also advocated the use of ironclad switchgear, not only to prevent disturbances in operation, but to eliminate burns and shock to employees. He did not see how leakage from one conductor can set up the sheath current and actuate the relays in the Merz-Price protective system.

W. L. Abbott told of the operating difficulties brought about by the use of high-tension cables which at first had very frequent breakdowns. In Chicago these have now been eliminated except in cables carrying over 9,000 volts. Mr. Abbott thought that if the money required for the installation of the Merz-Price system were put into better cable insulation it would produce better ultimate return.

D. W. Roper said that the requirements of central-station service are now becoming much more severe. He described a protective system employed by the Manhattan and Interborough power systems in New York where resistance is used in the neutral wire and selective protection from ground secured. An objection to the Merz-Price scheme is that the cable sheaths must be insulated throughout. If the lead sheaths are interconnected at manholes, as they are here to prevent electrolysis, the capacity current would return over all the cables in multiple and thereby make this protective scheme inapplicable. Another objection he saw was in the large number of current transformers required. Still another defect was that trouble on the pilot wires opens the switch even though the power cable itself is entirely intact.

Alfred Herz showed that if an auxiliary transformer is used, as seems to be indicated in the diagrams of the Merz-Price system, there must be some protection against the piling up of flux in the current-balance transformers.

George H. Lukes spoke of the need of reducing investment and operating costs of substations. In an extensive power system with many substations these costs would become almost prohibitive if the Merz-Price protective system were to be employed. Therefore, further simplicity instead of additional complication is desired. Mr. Lukes also asked whether the Merz-Price system has been used on aerial cable network. Mr. Lyman said it had.

H. B. Gear stated that the ring system used in the Northeast Coast supply network is particularly applicable there because the substations average only about 800 kilowatts in capacity, and three, four or even five of them can be grouped in one ring. Here, however, the substations seldom are less than 2,000 kilowatts, so that the radial system is necessary and, in fact, is as cheap as the ring system would be. Mr. Junkersfeld stated at this point that about 100 of the 150 substations in the Northeast Coast system are less than 200 kilowatts each. Others discussing the subject were H. M. Wheeler, D. Bowman and A. Alsaker.

Mr. Lyman closed the discussion by acknowledging that the Merz-Price system is not adapted to all situations. If the pilot cable is injured, immediate indication of that fact is given, but this does not interrupt the supply of the substation over other cables. The great advantage of this particular system is that it makes it possible to operate large distribution systems in parallel, thus reducing line losses and increasing the reserve capacity to the substations. The radial system has the reserve capacity and the reliability of the multiple system. The latter is really very simple. The little apparatus that is added is made up by other, that is, apparatus left out.

Thomson Effect and Thermal Conductivities at Glowing Temperatures.

In a paper read at the Washington meeting of the American Physical Society, A. G. Worthing described some experiments upon incandescent lamps.

The investigation, by an optical pyrometric method due to E. P. Hyde, of the energy losses in incandescent lamps due to the conduction of heat away from the glowing filaments at the leading-in and anchoring wires, has revealed a difference in the temperature variation along a glowing filament near such a cooling support, depending on the direction of the current through the filament. This difference is to be ascribed to the Thomson electromotive force which is always found when current flows in an electrical conductor in which a temperature gradient exists. The coefficient of this electromotive force in this case is expressible in terms of the difference in the electrical input for two elements of the glowing filament at the same temperature for the two cases of the current direct and reversed, the electrical current, and the two corresponding temperature gradients. The thermal conductivity is readily expressible in terms of the rate at which heat is conducted past a point of a glowing filament, the temperature gradient at that point and the cross section of the filament. There exists considerable uncertainty as to the temperature measurements. This uncertainty, however, does not affect the order of magnitude of the values obtained. At present the thermal conductivities have been expressed only in terms of their ratios to the electrical conductivities. The results are given in the accompanying table. These results suggest that tungsten-tantalum thermocouples at high temperatures should be three or four times as sensitive as platinum-platinum-rhodium thermocouples.

TABLE I.

Ratio of Thermal to Electrical conductivity in C. G. S. electromagnetic units divided by 10 to the tenth power.

Absolute Temperature.	Tungsten.	Tantalum.	Carbon.
1600	56	27	280
1800	73	33	270
2000	94	46	260
2100	103	56	240
Coefficient of Thomson Effect in microvolts per degree.			
1600	16	—5	—20
1800	22	—6	—20
2000	29	—8	—20
2100	33	—9	—20

New Electrical and Mechanical Appliances

THE MATTHEWS IMPROVED TELAFAULT.

Its Operation in the Testing of Power and Telephone Cables.

The principle involved in Matthews' improved Telafault is that of sending out over one conductor a pulsating or low-frequency alternating current and detecting it audibly on its return over another conductor connected to the former through some fault. It is obvious that a closed circuit can be established between a conductor and ground, or another conductor, provided such a conductor is connected electrically to the ground or the other conductor. The ground may have a high or low resistance and form a connection only when charged with an electric current at a potential that will break down the resistance.

Having established a closed circuit through the conductor or conductors in trouble and a source of energy, it is evident that current sent out over one side of the line will return by way of the other, with more or less loss which is governed by the electrical efficiency of the circuit. If some method of locating the circuit is at hand, which operates by the detection of the pulsating current with which the closed circuit is charged, it is clear that beyond the end of the circuit the detector will cease to respond to the charging current, and the end of the circuit will have become identified. As it is possible always to make up the circuit so as to place the ground or short-circuit causing trouble at the end of the improvised closed circuit, any apparatus fulfilling the conditions in the proper manner will detect such an end, and therefore the trouble.

The detector of the Matthews Telafault operates on the principle of induction. The chief cause for failure in previously designed apparatus was found to be the interferences set up by stray currents existing on every cable system, from outside sources. A detector to be of value must be so designed that it will register only the induction produced by the known sources of energy charging the closed circuit. The Matthews Telafault detector is designed so as to be non-sensitive to outside disturbances and very sensitive to the current furnished by the vibrator which forms a part of the apparatus. The machine is well constructed. All contacts and moving parts are so mounted as to insure a long life, and the adjustments are extremely simple.

The chief use to which the Telafault can be put is the location of all kind of troubles, except opens, in power, telephone, telegraph, fire-alarm telegraph and other cables containing a number of conductors or pairs. The operation of this instrument in connection with power cables will be treated first.

Testing Power Cables.

Power cables get into trouble from various causes in three general ways. The most common are grounds; second, short-circuits; third, opens. Any of these troubles on cables operating at pressures exceeding 5,000 volts usually produce mechanical results that are easy of detection by inspection, provided the trouble is within the walls of the manhole. Odors and smoke also occur with trouble on such cables, and usually lead to the detection of the trouble if it lies in the duct lines. It is rarely found that trouble on cables operating at over 5,000 volts cannot be determined without the aid of apparatus. However, it is estimated that not more than two per cent of the total cable in use is operated at a voltage exceeding 5,000. It is evident, therefore, that there exists a wide field in which low-tension power cables are used, where the use of the Telafault will prove an important conserver of time, and therefore of money.

The greatest loss of money to the central-station company occasioned by cable trouble is that due to the suspension of service, and not through the money necessary to repair the damage. Unlike the telephone and telegraph systems, the electric light or power cables do not contain spare conductors that can be pressed into service when others are in trouble. The apparatus served by the power cable stands idle until the trouble is cleared. It is true that in some cases duplicate cables are installed to guard against possible interruption of service, but such instances form a small per cent of the total installations. The rapidity with which the repairs are completed determines the "out-of-service" period, but more important than that, the rapidity with which the fault is discovered is the all-governing feature. For this reason all means possible should be employed by the central-station company to facilitate this important phase of operating conditions.

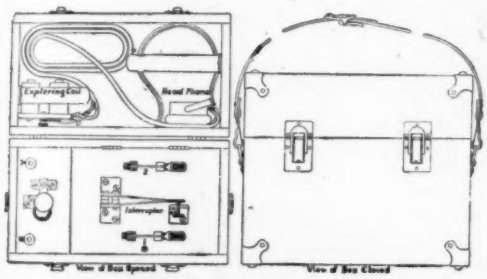
The instrument methods generally in vogue for determining the location of trouble are responsible more or less for "cut-and-try" methods. In a recent case it was necessary to make four splices on a duplex cable in as many manholes, before the trouble was discovered. The average cost of these splices was $4.00; an engineer was required to calculate the distance to the fault from the instrument readings, and incidentally he remained until the cable was in service. The total cost of repairing the cable was, as near as could be figured, $53 and the cable was out of service for a full working day and a part of the night. The loss of revenue was not determined, nor the wrath of the consumers registered. Two distinct disadvantages were demonstrated during this work: First, that any method requiring technical skill should be discouraged; second, the necessity for a "cut-and-try" method should be eliminated, as at best it is only approximate.

The first step to be taken in clearing trouble on underground low-tenston cable systems should be the removal from the line of all circuits by opening the switches. Following this the voltmeter method, a rough one, should be used to determine the approximate location of the fault. Then the station ends of the cable should be cleared from the bus, and leads from the interrupter of the Telafault connected to the cable in the manner shown by the diagram accompanying the apparatus. Two or more men, as the case may warrant, should be sent to the manhole "this side" of the approximate location, and with the telephone receiver to the ear, pass the detector over the cable sheath exposed in the manhole. If the induced current is passing over the conductors a hum will be heard in the receiver, plainly in synchronism with the interrupted current, and it is then known that the trouble lies beyond. If the hum is not heard, the trouble lies toward the station. In either case the

next manhole should be entered and the test repeated. If the induction in the receiver suddenly stops while testing the cable in the manhole, the point at which it ceases will be that at which the trouble may be found. If induction is heard in one manhole, and none in the next, the trouble lies in the ducts between them. So true are the indications furnished by the Telafault that it is unnecessary to compare this method with older ones where one splice after another is opened for test, and at last the weak spot determined.

Testing Telephone Cables.

The telephone, telegraph and fire-alarm telegraph cable plants are totally different from the power cable plant. In each of these cases spare conductors are provided in the cable to care for the two contingencies, trouble and growth. The first two generally make use of paper-insulated cable, while the latter invariably calls for rubber. Telephone and telegraph cables, commonly called dry-core cables, are susceptible to more trouble than cables insulated with saturated paper, rubber or varnished cambric.



The Matthews Telafault, Open and Closed.

Unquestionably the lead sheath is perfect when it leaves the manufacturer, as the cable is tested under water, but poor packing, rough transportation and handling in erection may damage it to such an extent that it will admit moisture, when perhaps it will not admit water in liquid form. There is no telling the exact effect such a trouble will produce. One day when the humidity is great, it may affect the working of one or more pairs, the next day, the cable may test absolutely free from grounds or crosses. It may spread along the core for as much as a span, or it may remain centralized within a very small area. The trouble may show an extremely high resistance to the passage of current, or it may appear metallic.

High-resistance grounds, crosses or short-circuits are very difficult of locating by the well-known instrument methods. In underground or aerial power cables of the above mentioned construction, which develop faults, the first procedure is to determine the approximate location by means of the resistance, or Wheatstone bridge method, using the Varley, Murray or Fisher loops. When this has been determined the trouble men should go to the proper manhole, if an underground cable, and proceed as in the case of the low-tension power test, taking care, however, to test all lateral cables, as the trouble might lie in a leg, and not show beyond the main cable as a consequence. The operations as described should be repeated until the trouble is located.

In the case of aerial cables, the terminals may be likened to the manholes of the underground system, and all tests made with reference to them as sectionalizing the line. When an approximate location has been obtained, the Telafault may be taken to the nearest terminal, there connected to the cable and the process of locating the trouble commenced. In all ordinary cases, it is preferable to ride the messenger, sliding the detector along as the cableman progresses. In some instances, however, messenger wires have so deteriorated by the action of the elements as to make it hazardous to send out a man on them. In this case, the detector may be mounted on the end of a bamboo rod of sufficient length and adjusted to slide along the cable, working from the ground.

Pin holes in the lead sheath are the greatest source of trouble in aerial cables that go "wet," producing high-resistance grounds. These holes are generally so small as to defy detection by inspection. Bullet holes, cracks, etc., are sometimes quickly found and repaired by close inspection, but those cases are few, and do not represent the average of cable troubles.

The bridge or other instrument methods of fault location are at best approximate, and results showing an error of one-half of one per cent in the average case are considered accurate. In the case of a cable 5,000 feet in length, such an error would mean a possible location 25 feet from the true one. To cut into the cable at various points for this distance is certainly a method to be discouraged, and that is what must be done to locate faults with no more accurate location methods. It is no secret among telephone men that all plants operated on the old methods of trouble locating are literally hacked to pieces.

By those who know of its principle, design and practical operation, the Telafault is considered a piece of apparatus for reducing maintenance costs. It is claimed to be the only instrument made that will locate "dead shorts" and wet spots. It has located high-resistance crosses and grounds up to 50,000 ohms. It will not "noise up" other pairs in a working cable. It requires four ordinary dry batteries and the instrument does not have to be taken out on the line. It is usually operated by the wire chief and a troubleman, who only has to take the head telephone and exploring coil with him. Its cost is low and there are innumerable instances when an expenditure of five times as much would have been economical ultimately. Its simplicity of operation and construction, absence of tables and technical formulas for use, places it within the grasp of every non-technical man. It is highly improbable that the maintenance cost for operating the Telafault will exceed $2 per year, all of which represents investment in new batteries. The Telafault has been placed on the market by W. N. Matthews & Brother, of St. Louis.

An Electrical Sterilizer.

The Presto Electrical Manufacturing Company, San Francisco, Cal., is putting on the market a unique sterilizer. It consists of a glass jar with a metal base and cover, into which is placed a small metal screen tray for holding the instruments or material to be sterilized. An electrical heating coil with a long handle and cord wired to an attachment plug, is placed in the bottom of the jar, and water poured to cover the wire basket completely. The small tray is removable, and may be used for other purposes if desired. The water in the sterilizer will be brought to boiling point within three or four minutes.

New Men in Crocker-Wheeler Company.

The organization of the Crocker-Wheeler Company has recently been strengthened by the addition of George W. Fowler, W. J. Warder, Jr., and A. K. Selden, Jr.

Mr. Fowler and Mr. Warder have joined the company's sales department while Mr. Selden enters its engineering department.

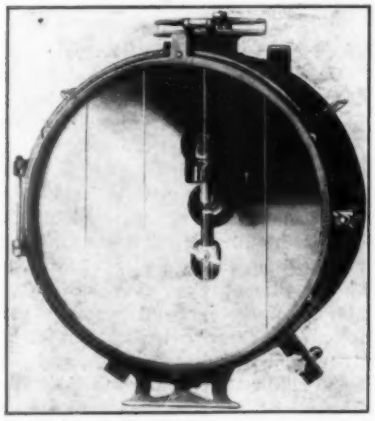
Mr. Fowler has been for many years the sales manager of the Garwood Electric Company.

Mr. Warder was formerly chief engineer and superintendent of Roth Brothers, in Chicago, and later was connected with the Westinghouse Electric & Manufacturing Co., at East Pittsburg.

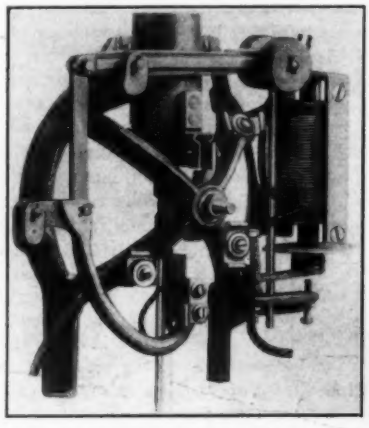
Mr. Selden, has for some years been in charge of the design of the interpole adjustable-speed motors manufactured by the Electro-Dynamic Company.

Metallic-Flame-Arc Headlights.

The rapid growth of the use of metallic-flame arc lamps has led to their adoption in another field formerly served by the carbon arc lamps exclusively, that of headlights on interurban electric cars. Such cars require a thoroughly reliable source giving a large volume of penetrating light. These characteristics, coupled with great economy of operation, are possessed to a high degree by the metallic-flame arc headlights now being put on the market. These lamps give much more light for the same expenditure of energy than do either carbon arcs or incandescents, and furthermore the light emitted is very penetrating thus adapting them particularly for headlight service. An additional advantageous feature of these lamps as made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is the fact that by reversing the direction of current through the electrodes by means of the plugs a dim greenish light is obtained which is very suitable for use when the car is traversing city streets.



Westinghouse Metallic-Flame-Arc Headlight.



Mechanism of Metallic-Flame-Arc Headlight.

These lamps are designed for use only on direct-current circuits, the voltage of which is above 120. They take four amperes and approximately seventy volts at the arc. To reduce the line voltage to that required at the lamp terminals, and also for the purpose of steadying the arc, there is supplied a resistor consisting of grooved porcelain spools, around which a special wire is wound, all closed in a readily removable case. The wire is made of a non-corrosive alloy that will not be affected by continual changes in temperature, and the resistance is such that it can be readily adjusted to give the proper voltage at the lamp terminals with a range of line voltage from 325 to 600.

Essentially, the metallic-flame arc headlight consists of a simple, rugged feeding mechanism (inclosed within a weatherproof case) arranged to feed a metallic electrode so that it will maintain a steady arc. Sheet iron is used in forming the body of the case, and the case rim and the door frame are brass castings. A hooded chimney is provided at the top, and a hinged door at the bottom for inserting the negative electrode. Supporting brackets, provided with hooks, fasten the headlight to a car dashboard. The hooks engage over a loop of strap metal, which should be provided on the dashboard of the car, or they may hang on the upper edge of the dashboard. Two adjusting screws, which have rubber-covered bumpers arranged to bear against the dashboard, are attached to extensions at the bottom of the case. These are used for properly directing the beam of light.

The glass front consists either of flat sections, in which case a parabolic reflector of spun brass, heavily nickeled and highly polished, is furnished, or of a semaphore lens. In both styles the rays projected from the headlight are parallel.

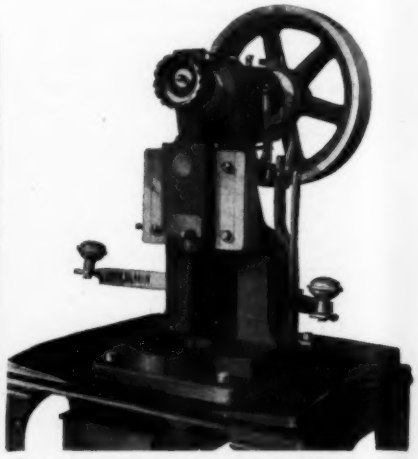
A feeding mechanism of very simple design has been developed for this headlight. It consists of a solenoid with its winding in series with the arc, which, through a positively acting clutch and a series of levers, feeds the electrode. The lower or negative electrode is attached to a lever and is drawn toward or away from the stationary positive electrode by the movement of the solenoid and clutch. The clutch engages an auxiliary rod attached to an operating lever. No dashpot is required. By turning a screw, the arc length can be adjusted.

The electrodes are similar in composition to those used in Westinghouse multiple and multiple-series metallic-flame arc lamps. The negative one is about five inches long and 0.5 inch in diameter and is composed of certain metallic oxides, largely magnetite. The positive one is a copper block. Negative electrodes have a life of 70 to 80 hours and the positive electrode will last about 500 hours. They can be changed without removing the mechanism from the case.

A particularly efficient application of this lamp is its installation on steam locomotives when used in connection with small turbo-generators train sets.

The Benjamin Safety Device For Stamping Presses.

The Benjamin safety device for stamping presses is intended to protect the hands of the operator of stamping presses, by necessitating the removal of both hands from the point of danger, to trip the press before the ram starts in its downward direction. The release of either hand permits the trip to return to its normal position, thus making it impossible for the press to repeat unless both hands are kept on the levers until the repeat operation is begun, in which event the operator would not have time to get his hands back into danger before the operation is completed.



Benjamin Safety Device for Stamping Presses.

The device consists of an operating lever normally inoperative, although free to move downward. This lever is made operative by the action of a retaining electromagnet through a circuit-closer located on the opposite side of the press. Consequently the press cannot be tripped by the operating lever unless the circuit through the magnet is first closed and retained closed until after the press has been tripped.

In addition to the protective feature, the use of the device results in an increased output of work where it is necessary to bring the hand into a position of danger for handling individual pieces. The operator knows the

press cannot trip until both hands are removed. The increased confidence thus created materially increases the number of operations actually performed, with a corresponding increase in the amount of work done.

This safety device can easily be adapted to all the standard presses. No drilling of holes is necessary. The magnets are wound for 110-volt direct current, but can be used on 220-volt direct circuits by use of suitable resistance in series, or it can be equipped for alternating-current circuits.

For demonstrating purposes the Benjamin Electric Manufacturing Company will furnish a sample on thirty days' trial. Further information may be secured by addressing the head office at 120-128 South Sangamon Street, Chicago.

Lifting Magnets for Handling Steel Pipe.

Lifting magnets for use in steel mills and other plants where large quantities of pig iron, scrap, etc., are handled are in everyday use. It is very commonly assumed that their efficient employment ends with these applications. There are, however, many profitable uses of smaller magnets and special-type magnets. Thin steel sheets, piping, etc., can be handled by magnets of the proper design.

A recent installation of two Cutler-Hammer eighteen-inch lifting magnets at the Chicago plant of the Rockwood Sprinkler Company has already verified the theory of H. M. Pulsifer, president of the Rockwood Company and designer of the plant. Fire protective sprinkler systems are designed, assembled and prepared in "knock-down" form for shipment at this plant. The material handled consists of steel piping, one-half to ten inches, fitting valves, sprinkler heads, etc. In Fig. 1, the magnets are shown unloading a carload of pipe, the crane trolley track being extended over the railroad spur for this purpose. From the cars the pipe is carried by the magnets into the storage house, Fig. 2, and deposited in compartments, according to size. The crane operator, alone, can do this work and as all the transporting is done from overhead, no floor space is needed for trucking and there is no interference with other work. The magnets operate steadily and noiselessly, accomplishing their work in quick time. Sprinkler equipments ready for shipment are also loaded by the aid of the magnets. The current taken by small magnets of this type is less than that required by the household electric iron. The consumption of current for each of the eighteen-inch magnets used in this plant is 1.9 amperes at 220 volts.

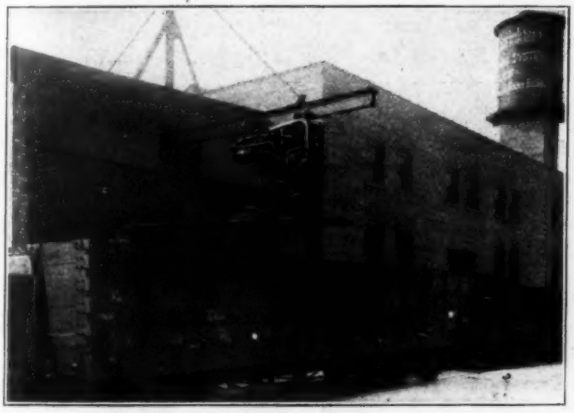


Fig. 1—Pair of Lifting Magnets Unloading Carload of Steel Pipe.

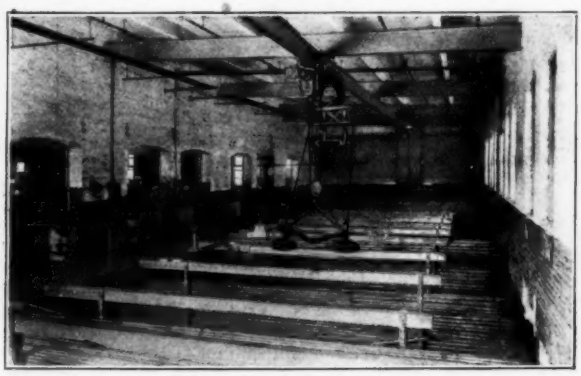


Fig. 2—Two Lifting Magnets in Operation in Pipe Storage House.

Equipment of the Gatun Hydroelectric Plant for the Panama Canal.

The award of the contract for the hydroelectric power plant at Gatun, Canal Zone, has been authorized to the Pelton Water Wheel Company for the water turbines at $85,200; the General Electric Company for the generators at $54,534, and the Niles-Bement-Pond Company for cranes at a price to be determined later.

This equipment is for the generating station that will furnish power to operate the gates, valves and other machinery of the locks, the regulating works of the spillways of Gatun and Miraflores dams, and will furnish the light for the same, as well as light and power all along the canal. The site for the power station is near the head of the spillway and the tailrace arches already built in the spillway wall can be utilized.

The General Electric Company undertakes to furnish three generators, 250 revolutions per minute, weight 116,200 pounds. Delivery under the contract will begin in 140 days and be finished in 200 days.

The Silvertown Train-Lighting System.

A new axle-driven electric train-lighting equipment has been placed on the market by the India Rubber, Gutta Percha & Telegraph Works Company, of Silvertown, London, England. It is based on patents granted to Anderson, Russell & Gray.

The equipment consists of a dynamo driven from the coach axle, and carrying on its shaft a governor which is used to operate the switchgear, and a double set of storage batteries, one of which is normally connected to the terminals of the lamp circuit, while the other is connected to the armature terminals so that it may receive a charge.

The dynamo is of ordinary construction and design except that the field magnets are differentially wound, one winding being a shunt winding connected by the switchgear to the terminals of the battery which at any given time is connected to the lamps (hereafter called the discharge battery), while the other is a series winding through which is passed the whole or a part of the current supplied by the dynamo to the second battery, called the charge battery. This winding is connected up by the switchgear so that it opposes the shunt winding, and tends to demagnetize or at least weaken the field in which the armature is rotating.

Connected as a shunt across the series winding is a resistance or diverter, which can be adjusted by hand to regulate the proportion of the charging current passing through the series winding. Thus, if the conditions of working are such that there is an increase in the ampere-hours of discharge from the batteries, the rate of charge of the charge battery can be increased, or if there is a decrease, the rate of charge can be decreased.

The armature shaft carries a centrifugal governor, so arranged that it

operates a cut-in switch when the speed of the armature is such that the dynamo, if excited by the shunt coils only, would give a voltage equal to the normal lamp voltage. This cut-in switch first connects the shunt circuit to the discharge battery so as to excite the magnets of the dynamo, and then connects the armature of the dynamo to the charge battery through the demagnetizing series coils and its diverter, and to the discharge battery and lamp circuit through the lamp resistances. The governor also carries on its collar a projection which, as soon as the armature begins to rotate, engages with a rocking lever which operates a reversing switch, provided there has been a change in the direction of the rotation of the armature. This collar works against a light spring for the first half-inch of its movement, so that it is quickly drawn away by the governor when making only a few revolutions per minute, sufficient for the projection to be clear of the rocking lever and thus prevent the repeated striking of the former against the latter. This reversing switch not only changes the connections between the armature and the batteries so that the dynamo gives current in the proper direction, but also changes the batteries over so that the one that was the discharge battery becomes the charge battery and vice-versa. In addition to the above, apparatus, a lamp switch is provided, so that all lights, or half the lights can be switched on, and which also couples the two batteries in parallel for charging when all lights are switched off.

Referring to the diagram of connections reproduced herewith, the numbers on the switchboard where a circle is shown denote the points at which the connections pass through the switchboard, and other numbers refer to the reversing and cut-in and cut-out switches; *9* *10* and *11* represent the cut-in and cut-out switch, and *1*, *3*, *7*, *5* and *2*, *4*, *8*, *6* the upper contacts and *1*, *7*, *3*, *5* and *2*, *8*, *4*, *6* the lower contacts on the reversing switch.

Assuming the train to be just starting and all the lamps to be switched on, the direction being such that the reserving switch is in the position shown by the full lines (upper contacts), the current will flow through the various circuits in the following manner: from No. 1 battery to upper contacts *6* and *8* to lamp switch and lamps back to No. 1 battery. A part of the current will be supplied by No. 2 battery through *2* and *4* through the series winding and its diverter, then through the lamp resistances to the lamps back to No. 2 battery.

When the speed has been increased sufficiently, the shunt winding will be connected to No. 1 battery to excite the shunt through contacts *6* and *8* to shunt coils and contacts *9* and *11* back to No. 1 battery, thus insuring the voltage being built up before the armature is connected with the batteries and lamps.

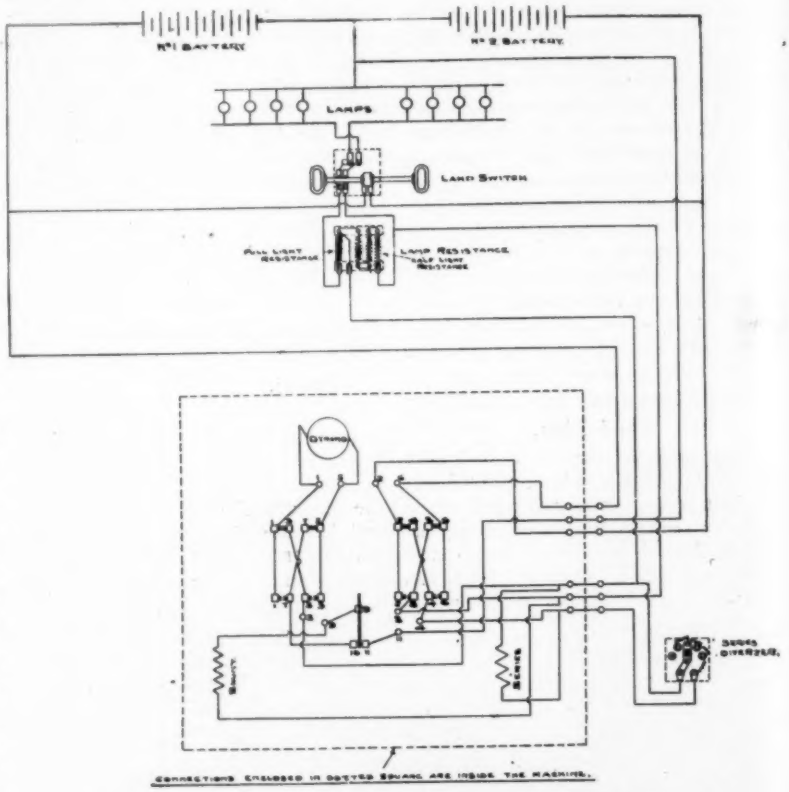
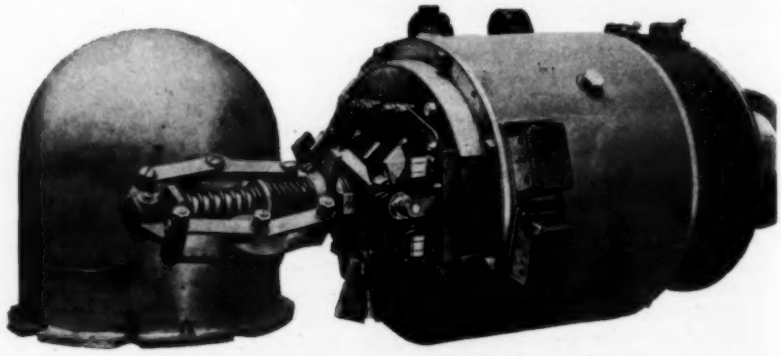


Diagram of Connections, Silvertown Train-Lighting System.

An increased speed will now connect *9* and *11* to *10*, and the armature will supply current to the load in the following manner: the current passes from the armature to contacts *1* and *3*, after which it divides, part going through the lamp resistances to the lamps and part through the series winding and its diverted and contacts *4* and *2* to No. 2 battery (which is the charge battery when running in this direction). The current from No. 2 battery will now join that from the lamps and pass through contacts *11*, *10*, *7* and *5* back to the armature.

If only half the lamps are required, the current will flow as before except that there will be no circuit through one group of lamps, nor through one of the lamp resistances which were in parallel for full lights. In the event of no lights being used, the two batteries are placed in parallel by the act of switching the lights off. In this case, the current will flow in the following manner: from the armature to contacts *1* and *3*, after which it di-



Train-Lighting Dynamo, Governor and Switchgear.

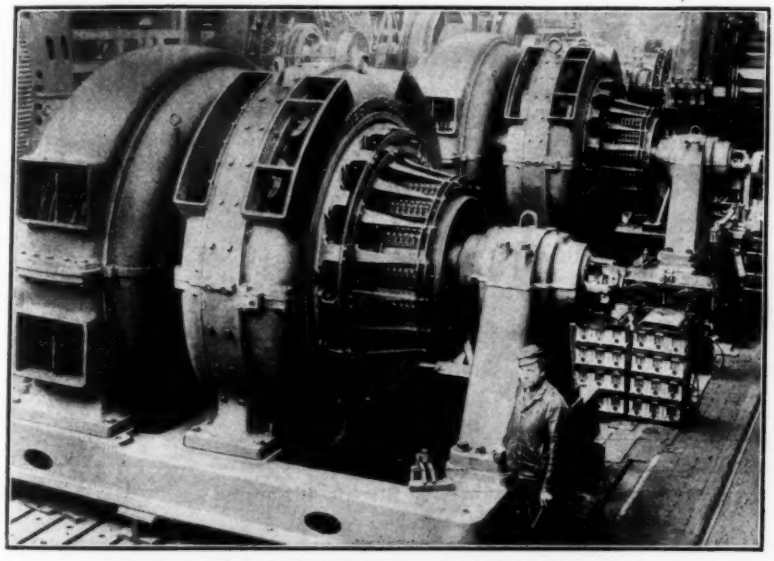
vides, part going to the series winding and its diverter and part to the "half-light" lamp resistance.

The current after passing through the series diverter and lamp resistance in parallel again divides, passing through both batteries and the shunt winding in parallel, and through contacts *11*, *9* and *10* to *7* and *5* to the armature.

The advantages claimed for the system of regulation described above are that it makes it practically impossible to charge the battery at an excessive rate, and that it provides an easy means of adjusting the amount of charge to the battery requirements.

Large Machines Being Built in Westinghouse Shops.

An example of the activity at the Westinghouse shops in building large machines is given in the view herewith, which was taken in one of the main aisles in the East Pittsburgh works, showing some unusually large and interesting machines being built by the Westinghouse Electric & Manufacturing Company. In the foreground are seen two motor-generator sets of particular interest. Each of these sets consists of a 2,250-horsepower, 12,000-volt, three-phase, sixty-cycle synchronous motor direct connected to and mounted on a common iron base with a 1,500-kilowatt, 250-volt, direct-current generator. These sets are for installation in a substation of the Cosmopolitan Electric Company that is being located in the basement of a department store in Chicago. The openings shown in the frame are for the attachment of conduits which will conduct the heat from the machines to the outside of the building.



Large Machines in Westinghouse Shops.

To the left and rear of the synchronous motor-generator sets is a 4,000-kilowatt rotary converter, recently shipped to the Interborough Rapid Transit Company, of New York City. This machine is capable of handling a maximum swing of 8,000 kilowatts. It is equipped with commutating poles, and is the largest rotary converter ever built. It will be of particular service in furnishing excess energy called for by the acceleration of the ten-car subway express trains.

To the right and rear of the motor-generator sets are shown some 3,000-kilowatt rotary converters built for the Chicago City Railway Company and the Philadelphia Rapid Transit Company. These machines clearly indicate the tendency of the operating companies toward the larger units.

In the immediate vicinity, but obscured from the view by the other machines in this aisle, are two 12,500-kilowatt, 6,600-volt, fifty-cycle 300-revolution-per-minute, vertical water wheel generators that are being built for the Rio de Janeiro (Brazil) Tramway, Light & Power Company. These are among the largest machines of this kind that have ever been built for this service.

Renewable Cartridge Fuses.

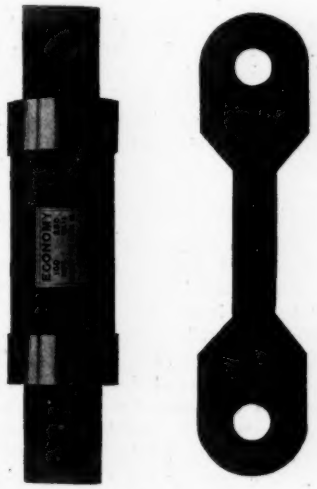
Since the advent of the cartridge inclosed fuse and its general adoption a number of years ago, there have been a number of attempts made to construct a product of this nature which would possess the necessary electrical characteristics and at the same time be renewable at low cost, as the continual replacement of a complete cartridge fuse, especially in places where fuses are blown frequently, increases the maintenance expense of the equipment very materially.

The Economy Fuse & Manufacturing Company, 504 Phipps Building, Pittsburgh, Pa., has recently placed on the market a renewable cartridge fuse, which is the result of very extensive laboratory experiments and the design of well known engineers.

The mechanical construction of the product involves several features not met with in previous products, one of the primary features, which reduces the shipping expense, being the extreme light weight, due to the fact that aluminum is used for all of the parts which do not carry current.

The shell used is constructed of the best grade of Gray Horn fiber.

As the electrical characteristics of a product of this nature are of primary importance, this company spent considerable time in developing a proper renewal which would not burn up or blow up the shell under every-day service conditions, and is offering to the trade a renewable-cartridge fuse, the electrical characteristics and operation of which agree in every respect with the specifications of the National Board of Fire Underwriters, whose rulings govern all devices of this kind. The company states that some of the largest factories, office buildings, mills and railroad companies in the country, after extensive laboratory tests, on this product and other types of renewable-cartridge fuses have unanimously adopted it as their standard.



Renewable Cartridge Fuse and Typical Fuse Element.

The company has just issued a very attractive pocket handbook and catalog giving tables of dimensions and specifications of the National Board of Fire Underwriters and a complete line of the company's fuses in all types and sizes, renewals and accessories.

The Waverley Exhibit at the New York Automobile Show.

The Waverley Company will exhibit at the 1912 New York Automobile Show the first electric limousine, a five-passenger car in which the driver occupies the front seat with no one to shut off his full view ahead. The car was designed more than a year ago and has been in constant service for the last four months.

The design was based on that of the town chariot of the first French empire, having a long sweeping curve from rear to front ending at the coupe pillar in a sharp backward curve that gives unusual elegance to this part of the car. A slight projection with rounded top here breaks the severe lines that usually mark the junction of the horizontal with the perpendicular. The body is surmounted by a slightly curved roof of simple dignified lines, giving the whole car an air of distinction that is seldom found in a horseless carriage.

Decorations of the car were designed by a noted artist, Frederick Richardson, of New York and Chicago. The exterior finish is in lustrous black with gold lines, gold-plated lamps, ivory-white wheels and window frames. The interior is upholstered with a rare and costly brocade of Louis XVI design, fawn color, rose and gold. The ceiling is in ivory-white, painted instead of upholstered, with a dainty border design in rose and gold reflecting the pattern of the brocade. The interior metal work is enameled in ivory-white with gold-plated mountings.

Among the interesting details will be found the unusual lighting arrangements of the car. All the lamps are of cut glass with gold mountings, a new acorn pattern being used throughout. The interior has a dome light in the center with two bracket lights over the rear seat and a meter lamp. The exterior is furnished with two head lights, two side lights and a tail light, all of harmonious pattern, and in addition a small light directly over the step, adding greatly to the safety of the passenger in entering or alighting.

The dimensions of this royal Waverley are: Length over all, 144 inches; wheel base, 104 inches; width of rear seat (no controller), 47 inches; depth, 21 inches; width of body over all, 56.5 inches; height, 60.5 inches.

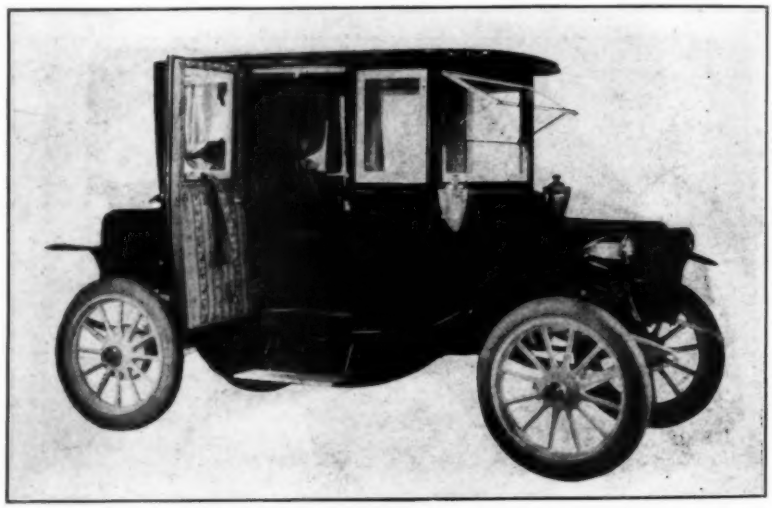
The equipment includes the Waverley high-efficiency shaft drive, no-arc controller, full elliptic springs with torsional supporting cross springs, and thirty-four cells of thirteen-plate Hycap or Ironclad battery.

While the chief interest of the Waverley exhibit will be centered on the new Waverley limousine, the rest of the exhibit deserves attention. Model 91 four-passenger Waverley brougham, an extremely handsome car, will doubtless be one of the most commodious and luxurious electrics to be seen on the floor. It is nine inches longer than last year's model of similar design, has wider and deeper seats and larger window openings.

Model 90, like Model 88, is a car of wholly new design, being a sheltered roadster built on up-to-date gasoline lines with folding semi-landaulet top, long front hood, trunk and tank at rear. Wheel steer is used exclusively in this car, its speed being above the normal for electric vehicles. Two headlights, two side lights and tail light are part of its furnishings. The fender is long, low and rakish, built of steel, and gives the car an exceedingly masculine appearance. The seats which provide comfortably for three passengers are all richly and deeply upholstered and every feature of the car is finished and distinguished in appearance. Its dimensions are: Length over all, 144 inches; wheel base, 104 inches; interior length, 57 inches; width of seat, 44 inches. There is a large disappearing seat for a third occupant. The equipment is the same as that of Model 88, except battery. The speed is 5 to 25 miles per hour.

In the commercial section, the Waverley Company will be represented by a three-ton chassis with a wheel base of 118 inches, gauge 73 inches, width of loading space 4 feet 6 inches and length, back of driver's seat, 13 feet. it is operated by forty-two cells of Hycap Exide battery, supplying current to two series-wound Waverley eighty-volt motors. The tires are 36 by 5 inches in front and 36 by 3.5 inches in rear. This truck is rated at a speed of nine miles per hour loaded with a mileage of thirty-five miles on one charge. The frame is made of five-inch channel steel; the members are hot-riveted throughout and fitted with heavy gusset plates. The axles are drop-forged alloy steel, the wheel pivots being ground and fitted with Timken roller bearings. Primary drive chains for this chassis are inclosed in metal cases fitted with hand plates that may be removed when desired. The front springs are semi-elliptic, while in the rear the platform type is used. There are two sets of brakes, one on the rear wheels and the other on the countershaft, both foot-operated. The Waverley controller is of the continuous-torque knife-blade type, located under the driver's seat, and fitted to a vertical lever.

There will also be exhibited a Waverley 86-A chassis with a carrying capacity of 2,500 pounds. This chassis has a 100-inch wheel base, a gauge of 56 inches, width for clear loading 40 inches, length back of driver's seat 8.5 feet. It is operated by forty-two cells, thirteen-plate battery supplying current to one series-wound eighty-volt Waverley motor. The frame material is armored wood.



The Waverley Electric Limousine.

In addition the company will exhibit a complete Model 83-600-pound delivery wagon built for Eli Lilly & Company of Indianapolis with a wheel base of 87 inches, gauge 54 inches, width of loading space 3 feet, length back of driver's seat 4 feet and height 4 feet. The battery is of twenty-three-cell Hycap type, the motor is a sixty-volt thirty-five ampere Waverley motor, series wound for high torque. This car is operated through the Waverley shaft drive similar to that used on Waverley pleasure cars and noted for its 98.7 per cent efficiency and absolute noiselessness. The body is of handsome design, with metal screens on the sides.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

ALLISON, IOWA.—The town has voted for an electric-light system. C.

BIWABIK, MINN.—The Council will install a "White Way" system in this town. C.

WAYZATA, MINN.—This city has voted $15,000 in bonds for an electric light plant.

ORANGE CITY, IOWA.—F. W. Michel is about to put in an electric light plant.

GALVEZ, LA.—This city has voted bonds for the construction of an electric light plant.

DUFUR, ORE.—The City Council is planning to extend the local electric-lighting system. A.

ANTIOCH, CAL.—The Board of Trustees are preparing plans for a municipal power plant.

MAQUOKETA, IOWA.—J. Frank Barnes has been granted an electric-light franchise here.

ALLISON, IOWA.—Claude Mackey, Waverly, has been granted an electric-light franchise here.

BEATTIE, KAS.—Harry D. Hockman has been granted a twenty-year electric-light franchise.

LEMMON, S. D.—The Lemmon Electric Light & Power Company has been granted a franchise.

VIVIAN, LA.—The Caldwell & Heath Electric Company is about to erect a power house here.

MINEOLA, TEX.—The Minneola Ice, Light & Water Company is about to install additional equipment.

SHELDON, IOWA.—The city is considering the installation of an electric plant in connection with the waterworks.

MENLO, IOWA.—George C. Buckley & Company have been granted a franchise for an electric light plant in Menlo. C.

COATESVILLE, IND.—A favorable vote has been taken on the bonding of the town for putting in an electric-light system.

REMSEN, IOWA.—M. R. Faber and other prominent citizens are behind a move to install an electric light plant at this place.

MANCHESTER, GA.—A municipal electric lighting system is to be installed at Manchester at the earliest possible date.

ABERDEEN, S. D.—The Electric Light & Power Company will install a complete new power station and plant to cost $200,000. C.

SAN JOSE, CAL.—The Great Western Power Company has been granted a franchise for electrical power distribution in this city.

MT. VERNON, IOWA.—The Cedar Rapids & Iowa City Electric Light & Power Company will proceed with the construction of a line to this city. C.

M'KITTRICK, CAL.—The San Joaquin Light & Power Company, Fresno, plans for the immediate installation of a street-lighting system at McKittrick. A.

KINGMAN, ARIZ.—The Santa Fe Company is going to install electricity in all the buildings and yards of the company. Work will begin early in January.

HARRISBURG, PA.—The Washington Township Electric Light & Power Company has been granted a charter to operate in Lehigh County, with a capital stock of $5,000.

BAIRD, TEX.—The Baird Light & Ice Company has been formed here, with a capital stock of $20,000. The incorporators are P. A. Hooger, W. W. Wedeborn and E. M. Smith. D.

HARRISBURG, PA.—The North Whitehall Township Electric Light & Power Company has been granted a charter to operate in Lehigh County, with a capital stock of $5,000.

RED WING, MINN.—The Board of Water Commissioners is considering the advisability of installing apparatus at the pumping station so as to pump all city water by electric power.

ST. LOUIS, MO.—The Mexico Power Company, Mexico, has been incorporated with a capital stock of $300,000. The incorporators are S. M. Locke, E. K. Locke and P. E. Locke.

GLENDALE, CAL.—The municipal electric-lighting plant will soon commence the installation of a lighting system in the Piedmont Park district. H. B. Lynch is manager of the municipal plant. A.

EMMETT, IDA.—The Idaho-Oregon Light & Power Company plans for the erection of a hydroelectric power plant on the Payette River. It is said that $250,000 will be expended in the work.

FERNIE, B. C.—The Bull River Power Company will soon commence the erection of a 10,000-horsepower hydroelectric power plant, with a system to furnish light and power at Fernie. A.

COLDWATER, OHIO.—The Coldwater Lighting Company has been incorporated with a capital stock of $10,000. William Jasperson, M. Jasperson, M. E. Smith and C. W. Backus are the incorporators.

PRESTON, IDA.—The Idaho-Utah Electric Company, recently incorporated, plans for the establishment of an electric light and power plant, with distributing system to serve Preston and vicinity. A.

DAYTON, O.—The Kimball Light, Power & Water Company has been incorporated with a capital stock of $50,000. The company will construct an electric light and power plant at Kimball, W. Va.

NEEDLES, CAL.—The Needles Gas & Electric Company, recently incorporated, plans for the installation of an electric-lighting and gas system at Needles. Henry Torchiana is head of the company. A.

HATFIELD, WIS.—The La Crosse Water Power Company will rush construction on rebuilding the dam here in order to have it completed before the spring freshets. The work will cost about $100,000. C.

FREDERICKTOWN, MO.—The Fredericktown Light & Power Company has been incorporated with a capital stock of $15,000. The incorporators are Earl Gates, A. J. Boardmen and R. G. Stevenson.

DAYTON, OHIO.—The Algonquin Light, Heat & Power Company has been incorporated with a capital stock of $10,000. Fanny H. Peirce, J. Elliot Peirce, Mary Frances Peirce, Virginia Peirce Wood and Lee Warren James are the incorporators.

OXNARD, CAL.—The Board of City Trustees is having plans prepared by Olmstead & Gillelen, engineers, Wright & Callendar Building, Los Angeles, for an ornamental street-lighting system, comprising concrete posts, to cost about $25,000. A.

ANDERSON, IND.—The Board of Public Works is receiving bids for the installation of a new 1,500-horsepower turbine engine and other electrical equipment for the municipal electric light plant. The estimated cost of needed machinery is $40,000. S.

FALLON, NEV.—The United States Reclamation Service, Los Angeles, Cal., O. H. Ensign, electrical engineer, is preparing plans for new substations to be erected by the government along the route of its transmission system from Lahonton Dam to Fallon. A.

DIXON, CAL.—The Pacific Gas & Electric Company has commenced the erection of a new substation at Dixon. The company is planning for the construction of a power line through the district south of Wheatland to furnish electric energy for lighting and power purposes. A.

SEATTLE, WASH.—The Colonial Oil Company has been incorporated with a capital of $12,500,000 by J. M. Hosom, B. H. Silver and C. A. Thurston, all of Seattle. The company proposes to establish electric-power and gas-generating plants as well as operate in oil properties. A.

MANHATTAN, N. Y.—The Southwestern Power Company has been incorporated with a capital stock of $100,000 for the purpose of manufacturing electricity for power. William D. Johnson, Hartford, Conn.; Frederick W. Krosteller, New York City; Frederick M. Livingston, New York City, are the incorporators.

WAKONDA, S. D.—The Wakonda Light, Power & Heating Company has been organized here with the following officers: President, F. A. Swezey; secretary, Samuel Jacobson. The com-

pany has already commenced work on building a power house to be used in connection with the lighting and power systems which will be installed.

SPANISH FORK, UTAH.—The Palmyra Telephone & Electric Light Company, recently incorporated, will soon commence the erection of an electric-lighting plant at Spanish Fork. A transmission and distributing system will be constructed throughout this section. High-tension energy will be obtained from the government power plant in Spanish Fork Canyon. A.

SAN DIEGO, CAL.—In its plans for the coming year the San Diego Consolidated Gas & Electric Company announces its intention of installing a 3,000-kilowatt horizontal steam turbine generator, with 1,000 horsepower additinal boiler capacity at its generating station. The company's transmission system will be extended from La Jolla to Del Mar and from Lemon Grove to Encanto, a total distance of about fifteen miles. A.

PORTLAND, ORE.—The Portland Railway, Light & Power Company has announced improvement plans for the coming year aggregating an expenditure of about $1,500,000. A new substation, mainly for power supply for various industries, is planned in West Portland at a cost of approximately $100,000. New overhead and underground distributing lines, rebuilding and extensions, will cost about $1,000,000. Other improvements to the company's system are estimated to require the balance of the appropriation. The company will immediately increase the capacity of its power station "E" in North Portland, and has placed an order for a 10,000-horsepower steam turbine and generator. A.

LOS ANGELES, CAL.—As provided by its recent bond issue, the Pacific Light & Power Corporation has recorded a mortgage in favor of the United States Mortgage & Trust Company of New York for $35,000,000 covering all of its California properties. Of such sum $9,015,000 is to be appropriated to secure the company's outstanding bond issue of $9,000,000; $3,000,000 for like purpose for the bonds of the Southern California Gas Company, a subsidiary corporation, and $10,000,000 for the construction of the proposed hydroelectric power plant at Big Creek, near Shaver. The balance of the issue will be used for improvements and additions in the plants and system as necessitated. The Big Creek plant is estimated to require four years to fully complete, with an estimated capacity of 300,000 horsepower, during the first two of which 70,000 horsepower is to be developed. Transmission lines and distributing stations will be constructed from the San Joaquin Valley to Los Angeles, a distance of about three hundred miles. A.

ELECTRIC RAILWAYS.

(Special Correspondence.)

MUSCATINE, IOWA.—William S. Dows, Cedar Rapids, Iowa, is promoting an electric line between here and Iowa City.

RIVERIA, TEX.—Theodore F. Koch of this place will construct an interurban railway between Riveria Beach, a distance of about ten miles. D.

DEVILS LAKE, N. D.—The Stotler Investment Company is ready to place orders for electrical machinery for the proposed Chatauqua electric line. C.

PRINEVILLE, ORE.—It is proposed to build an electric road from Prineville to connect with the Oregon Trunk & Deschutes Railroad, and the Prineville & Eastern Railway Company has been granted a franchise.

PASCAGOULA, MISS.—It is planned to run an electric railroad from Mobile to this city. Judge Austill, of Mobile, president of the West Shore & Mobile Traction Company, is interested in the project.

MADISON, WIS.—The Chicago & Wisconsin Valley Railroad Company is planning to build an interurban line between Madison and Portage. It is the ultimate plan of the company to have the line include Merrill and Janesville.

EBENEZER, TEX.—The Alamo Land and Sugar Company will construct an interurban loop railway through its 32,000-acre tract of land near here. It will also construct a large irrigation system, including a pumping plant and distributing canals and ditches. D.

BEARDSTOWN, ILL.—The Beardstown Street Railway Company has been incorporated with a capital stock of $50,000 to operate a street railway in Beardstown. The incorporators are Stephen H. Cummins, J. F. Adkins, C B. Meredith.

DALLAS, TEX.—The Southern Traction Company proposes to build an interurban electric railway to run from Dallas to Waco and from Dallas to Corsicana by way of Ferris, where the lines will diverge, a total distance of approximately 134 miles. D.

WESTON, W. VA.—The Weston Council has granted a franchise for an electric line to the Clarksburg & Weston Electric Railway Company over the streets of the city. The line may be extended to connect with the Fairmont and Clarksburg traction system.

PASADENA, CAL.—The Board of Supervisors has granted the Pacific Electric Railway Company a thirty-year franchise for a line on Washington street from the city limits to a point near Santa Anita avenue. A consideration of $100 was given for the privilege. The company will commence construction at once. A.

BAY CITY, ORE.—The Portland & West Coast Railway & Navigation Company has made application for a franchise on certain streets in Bay City. The company has been granted franchises at Sheridan, Willamina, Bentley, Tillamook and other cities, and in connection with its proposed system is said to be planning for the construction of a hydroelectric power plant. General Manager Fitzgerald is in charge. A.

LANCASTER, O.—There is an electric railroad project to construct a line from Lancaster to Liberty, Stitzer and Fennimore, then west to Mount Hope, thence to Patch Grove, south to Bloomington, north to Andover, east to Lancaster and from there to Ellenboro and Lima. From Lima across the country to Warren, Ill., where it would connect with the Great Western Railroad. Thomas McDonald, who is the promoter, already has $20,000 subscribed toward the building of this road.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

HILL CITY, MINN.—Bert Wideman has been granted a telephone franchise.

BOYCE, TEX.—W. B. Kidd of Rice, Tex., will install a telephone exchange and system at this place. D.

MANKATO, MINN.—The village of North Mankato is negotiating for the purchase of a fire-alarm system. C.

MAYSVILLE, MO.—The De Kalb County Telephone Company will construct 1,200 miles of telephone line.

DENISON, TEX.—This city has voted a telephone franchise to the Southwestern Telegraph & Telephone Company.

HAIGLER, NEB.—The Caldwell-Haigler Telephone Company has been incorporated with a capital stock of $1,000.

HALSTEAD, KANS.—The South Lakin Telephone Company has been incorporated with a capital stock of $10,000.

DODGE CITY, KANS.—The Dodge City and Colmor Telephone Company has been incorporated with a capital stock of $500.

SHEBOYGAN, WIS.—Articles of incorporation have been filed by the Cascade Telephone Company with a capital stock of $3,000.

SPOKANE, WASH.—The Home Telephone Company has announced that it will expend approximately $500,000 in Spokane in 1912.

NEZ PERCE, IDAHO.—The Independent Telephone Company has commenced the reconstruction of its lines between Nez Perce and Kamiah. A.

SAN FRANCISCO, CAL.—The Board of Supervisors has appropriated the sum of $12,400 for the installation of a police-signal system in the business district. A.

ANIWA, WIS.—The Aniwa Telephone Company has been incorporated with a capital of $6,000. The incorporators are A. J. Peterson, George M. Goldring and J. A. Manser.

HENRY, ILL.—The Henry Telephone Company has been incorporated with a capital stock of $2,500. The incorporators are E. S. Sterrett, C. A. Camp and Fred W. Potter.

EPHRATA, WASH.—The Green Valley Telephone Company has filed articles of incorporation with $5,000 capital stock. The directors are A. Owen and J. Pierce.

EPHRATA, WASH.—The Green Valley Telephone Company has been incorporated with a capital stock of $5,000. A. W. Owen and J. M. Pierce are named among the incorporators.

PESOTUM, ILL.—The Pesotum Home Telephone Company has been incorporated with a capital stock of $2,200. The incorporators are Henry Pfeffer, E. V. Burton and Charles Eichhorst.

DES MOINES, IOWA.—The Farmers' Mutual Telephone Company, Stanton, has been incorporated with a capital stock of $10,000. The incorporators are H. M. Dirrim, J. O. Clauder and J. X. Larson.

ELLSWORTH, WIS.—The Farmers' Consolidated Telephone Company has been incorporated with a capital stock of $25,000. The incorporators

are C. J. Christianson, Herman Peterson and Edward Snow.

LAPWAI, IDA.—The Tom Beall Telephone Company has been incorporated with a capital of $10,000 to build a line from Lapwai to Tom Beall. W. W. Olds and J. W. Fenderson are at the head of the company. A.

HENNING, MINN.—The Henning-Start Telephone Company has been incorporated with a capital stock of $3,500. The incorporators are Charles Johnson, M. Peterson, Ole Oleson, Anton Hanson and others.

EUREKA, MONT.—The Eureka Mutual Telephone Company of Lincoln County has been incorporated with a capital stock of $20,000. The directors are F. P. Corey, P. N. Bernard, A. M. Mikalsom, F. B. Bogardus and J. W. McCalder, all of Eureka.

BUCKLEY, ILL.—The Buckley Telephone Company has been incorporated with a capital stock of $20,000, to engage in a general telephone and telegraph business. William S. Hale, Harry S. Bossart, Edwin Hull, Frank E. Singleton and William Krumwiedie are the incorporators.

TROUTLAKE, WASH.—Residents in the White Salmon Valley have organized a mutual telephone company and have made application to the Board of Supervisors of Klickitat County for a franchise for a line from Troutlake to Underwood, a distance of about twenty-three miles. A.

NEVADA CITY, NEV.—The Tahoe national forest is to have a private telephone line between Nevada City and North Bloomfield. The new system will be constructed during the winter months by Forest Ranger J. H. McIntosh, who will be temporarily located at the ranger's house at North Bloomfield.

PIERRE, S. D.—Articles of incorporation have been filed by the Great Western Telephone Company with a capital stock of $80,000. The headquarters are to be at Huron. The incorporators are E. M. Taylor, M. L. Taylor, W. J. Taylor, Crookston, Minn.; P. M. Lorenz, Dubuque, Iowa; A. C. Foldesi, Huron.

SAN BERNARDINO, CAL.—The Southern Sierras Power Company will soon commence the construction of a private telephone line from Bishop to San Bernardino, a distance of two hundred and forty miles. The line will parallel the company's transmission line, now building, and is said to be the longest private line in existence. A.

LOS ANGELES, CAL.—The City Council has adopted specifications and will soon call for bids for the installation of a fire-alarm and police-signal system. The system will comprise about 1,000 fire-alarm boxes and 500 police-signal boxes, extending over the entire area of the city. The installation will cost about $500,000. A.

WILLOWS, CAL.—At a meeting of the stockholders of the Glenn County Telephone Company the capital stock was increased from $100,000 to $200,000. The additional funds will be devoted to construction work. Lines are planned to Sacramento and San Francisco in conjunction with the Postal Telegraph Company. W. H. Travis is manager of the company. A.

PORTERVILLE, CAL.—The Ducor-California Hot Springs Company recently organized, plans for the immediate construction of a telephone system between Porterville, Ducor, Terra Bella, Hot Springs and Richgrove, a total distance of about forty miles. L. S. Wingrove, Hot Springs, and F. M. Carlisle, Ducor, are at the head of the company. A.

PERSONAL MENTION.

W. E. DICKINSON, Morgantown, W. Va., has been made professor in charge of the department of electrical engineering in the West Virginia University.

JOHN FLETCHER has been appointed telegraphic superintendent of traffic, a new position created by the Canadian Pacific Railway. He was formerly superintendent of the British Columbia lines.

THEODORE P. SHONTS, New York, is said to be chosen as the president of the New York Railways Company, which took over the franchises, tracks, equipment and real estate of the Metropolitan Street Railway Company, January 1.

RICHARD SHERWOOD SATTERLEE, formerly second vice-president of the Habirshaw Wire Company, Yonkers, N. Y., was elected president of the Company on January 1. Mr. Satterlee has been connected with the Habirshaw interests for ten years, and for several years past has been second vice-president and a member of the board of trustees of that company. Mr. Satterlee is highly esteemed throughout the electrical fraternity and is well known in wire circles for his activity and enterprise in following out a vigorous executive policy.

R. S. Satterlee.

H. L. FURR, Harrisonburg, Va., who for seven years has been connected with the Harrisonburg Mutual Telephone Company, has resigned his position as manager and wire chief, to devote his entire time to the business of Furr Brothers.

JOHN CROSBY NEELY announces that he has become associated with N. W. Halsey & Company, with offices in New York, Philadelphia and San Francisco. Mr. Neely will make his headquarters at 125 West Monroe Street, Chicago.

CARL KELLER, general commercial superintendent of the New England Telephone and Telegraph Company, made an address on December 7, at the Waterbury Telephone Club, Waterbury, Conn. Representatives from most of the telephone exchanges in the state were present.

J. E. BROYLES, Fort Wayne, Ind., who recently resigned as joint agent for the Fort Wayne & Northern Indiana Traction Company and the Indiana Union Traction Company at Bluffton, has been appointed head of all ticket and freight agents on the former system, with headquarters at Fort Wayne. S.

GEORGE H. GRAY, Chelsea, Mass., superintendent of the Chelsea Division of the Bay State Street Railway, has been promoted to succeed General Superintendent Frank G. Wilkinson, of the same road, with headquarters at Lynn, effective January 1. Superintendent James O. Ellis, of Wakefield, succeeds Mr. Gray. Mr. Wilkinson, who has been a railway man for 32 years, will retire.

AUSTIN C. DUNHAM, for thirty years president of the Hartford Electric Light Company, and one of the best known electric light men in the United States, is planning to retire from presidency of the company on February 13. It is expected that Samuel G. Dunham, now vice-president, will succeed his brother as president, and that Samuel Ferguson, now with the General Electric Company, will become vice-president.

C. LOOMIS ALLEN, EDWARD F. PECK and JOHN RAPELJI are on the directorate of the Allen & Peck Company, organized with headquarters at Albany, N. Y., to do a business of engineering, financing and operating public utilities. Mr. Allen is vice-president and general manager of the Utica & Mohawk Valley, the Oneida Railway Company, the Syracuse Rapid Transit and other electric railway companies. Mr. Peck is general manager of the Schenectady (N. Y.) Railway Company.

SEVERN D. SPRONG has resigned his position as chief electrical engineer of J. G. White & Company, Incorporated, and accepted that of electrical engineer of the Brooklyn Edison Company, retaining the relation of consulting electrical engineer to J. G. White & Company. Mr. Sprong's new position, in his home city, in which he took up his duties on January 1, is one for which he is exceptionally fitted, and for his success in it he has the good wishes of J. G. White & Company.

OBITUARY.

HAINES LLOYD HART, an engineer and a graduate of Cornell University, died of meningitis in New York, on January 5. He was connected with the Westchester Lighting Company. He is survived by two sisters. Mr. Hart was a native of Auburn, N. Y., and was 27 years of age.

MISS MARJORIE BETHELL, only daughter of Union Noble Bethell, president of the New York Telephone Company, died on January 5 at her home, 720 Upper Mountain avenue, Montclair, N. J. Miss Bethell, who was seventeen years old, had been ill for the last two months. She was a member of the senior class of the Montclair high school. Besides her parents she is survived by three brothers.

ENGELBERT ARNOLD, professor of electrical engineering in the technical college at Karlsruhe, Germany, died on November 16, 1911. Professor Arnold was well known the world over for his work on electrical machinery and as the author of a number of standard treatises on this subject. He was especially an authority on commutation, and in connection with J. L. LaCour read a paper in 1904 at the International Electrical Congress at St. Louis on this subject. Professor Arnold was born March 7, 1856, in Switzerland, and studied at Zurich. He was called to the chair at Karlsruhe in 1894.

FINANCIAL NOTES.

The first week of the new year found the market outlook somewhat confused, and the general opinion seems to be that price fluctuations for some time to come will continue irregular. Improvement in iron and steel has been accompanied by similar improvement in the copper trade, and the optimism generated thereby will spread to other lines of industry. It is significant that the improvement in the electrical industry as a rule generally bears an exact relation to the improvement in iron and steel. It is expected that following the improvement of the last quarter in the latter industry that the elecrical industry is now due for a period of improvement, and, as a matter of fact, this is the well-defined opinion of those who are in the best position to be well informed.

Full reports for 1911 will indicate a number of changes in the electrical business. The first six months were dull, with orders slow and prices low. The largest companies making electrical machinery will show a falling off in earnings for 1911 over those shown for last year. Western Electric, on the other hand, will show a profitable year and gross sales are expected to be about $66,000,000, as compared with $61,000,000 last year and $46,000,000 in 1909. With the exception of 1906, the current year will be the best in the history of the company.

The United States Mortgage & Trust Company has filed application in the Federal court at Toledo for a receiver for the Toledo Railways & Light Company, operating the street railway and lighting systems. This is the first formal step in the reorganization of the company and was brought about by the Protective Bondholders' Committee, which has allowed the company to default on its four per cent bonds' interest for the past three years.

The United Electric Light & Water Company has taken over the control of the Housatonic Power Company, operating the electric light business at Waterbury, Watertown, Cheshire, New Britain, Newington, Plainville, Southington, South Norwalk, Wilton, New Canaan, Weston, and the gas and electric business at Naugatuck, Norwalk and Greenwich.

Theodore N. Vail, president of the Western Union Telegraph Company, has issued a statement denying that there is any cable rate war or that any cutting in cable rates is intended.

The American Gas Company, Philadelphia, has closed negotiations for the purchase of the Citizens' Gas & Electric Company, serving a population of about 35,000 in Waterloo and Cedar Falls, Iowa.

Dividends.

American Light & Traction Company; the regular quarterly dividends of one and one-half per cent on the preferred stock and two and one-half per cent cash and two and one-half per cent in common stock on the common stock, payable February 1 to stock of record January 16.

Auburn & Syracuse Electric Railroad Company; preferred dividend of three per cent, payable January 15.

Boston & Suburban Electric; quarterly preferred dividend of $1 per share, payable January 15.

Brooklyn City Railroad; quarterly dividend of two per cent, payable January 15.

Commonwealth Edison Company; the regular quarterly dividend of one and three-fourths per cent, payable February 1 to stock of record January 15.

Fort Smith Light & Traction Company; preferred quarterly dividend of one and three-fourths per cent, payable January 15 to stock of record December 30.

Ottumwa Railway & Light Company; quarterly preferred dividend of one and three-fourths per cent, payable January 15 to stock of record December 30.

Northern States Power Company: quarterly preferred dividend of one and three-fourths per cent, payable January 15 to stock of record December 30.

Rio Janeiro Tramway, Light & Power Company; quarterly dividend of one and one-fourth per cent, payable February 1.

Shawinigan Water & Power Company; quarterly dividend of one and three-fourths per cent, payable January 20 to stock of record January 8.

Union Traction of Indiana; common dividend of one per cent, payable January 10 to stock of record January 4.

Western States Gas & Electric Company of Delaware; quarterly dividend of one and three-fourths per cent, payable January 15 to stock of record December 30.

Worcester Electric Light Company; quarterly dividend of two and one-half per cent.

The Union Trust Company; extra dividend of $50 a share, payable December 23.

The Union Trust Company; regular quarterly dividend of $25 a share, payable January 1.

Reports of Earnings.

AMERICAN LIGHT & TRACTION.

The report of the American Light & Traction Company for the month of November and eleven months ended November 30, compares as follows:

	1911.	1910.
November gross	$ 401,099	$ 395,621
Expenses	9,540	9,180
November net	391,559	386,441
Eleven months' gross	3,694,443	3,405,462
Expenses	104,166	109,730
Eleven months' net	3,590,277	3,295,732

KEYSTONE TELEPHONE COMPANY.

The report of the Keystone Telephone Company of Philadelphia for the month of November and five months ended Nov. 30, compares as follows:

	1911	1910
November gross	$ 98,496	$ 96,474
Net	48,636	48,369
November surplus	23,665	23,977
Five months gross	486,826	475,628
Net	238,900	237,985
Five months surplus	114,540	115,434

AMERICAN TELEPHONE COMPANY.

The American Telephone & Telegraph Company reports to the New York Stock Exchange for the ten months ended October 31, 1911, as follows:

Revenue.	
Dividends received	$15,438,090
Telephone traffic	8,762,479
Real estate	78,467
Interest and other revenue from associated companies	8,699,124
Other interest	454,868
Sundry	2,488
Total receipts	33,435,519
Disbursement.	
Expense of administration	$ 2,437,518
Interest	4,651,595
Taxes	578,308
Telephone traffic	4,699,979
Total	12,367,404
Surplus	21,068,115
Dividends (nine months)	16,285,908
Surplus	4,782,207

EDISON COMPANY OF BOSTON.

The report of the Edison Electric Illuminating Company, of Boston, for the month of November and five months ended November 30, 1911, compares as follows:

	1911	1910
November gross	$ 547,177	$ 485,156
Expenses	206,571	197,909
November net	340,606	287,247
Five months gross	2,187,986	1,943,776
Expenses	939,448	877,597
Five months net	1,248,538	1,066,179

NORTHERN OHIO TRACTION & LIGHT.

The report of the Northern Ohio Traction & Light Company for the month of November and eleven months ended November 30, 1911, compares as follows:

	1911	1910
November gross	$ 214,562	$ 189,705
Expenses	125,204	110,718
November net	89,359	78,987
Charges	43,730	43,366
November surplus	45,629	35,620
Eleven months gross	2,454,651	2,235,453
Expenses	1,359,562	1,233,947
Eleven months net	1,095,089	1,001,506
Charges	487,120	476,894
Eleven months surplus	607,969	524,612

TWIN CITY LINES.

The report of the Twin City Rapid Transit Company for the month of November and eleven months ended November 30 compares as follows:

	1911	1910
November gross	$ 633,968	$ 619,149
Expenses	317,628	319,732
November net	316,340	299,417
Charges, taxes and preferred dividends	148,079	137,912
November surplus	168,261	161,505
Eleven months gross	7,141,998	6,884,876
Expenses	3,530,330	3,316,581
Eleven months net	3,611,667	3,568,294
Charges, taxes and preferred dividends	1,548,871	1,539,886
Eleven months surplus	2,062,796	2,028,408

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Jan. 8.	Jan. 1.
Allis-Chalmers common (New York)	1¼	1⅜
Allis-Chalmers preferred (New York)	8	7⅞
American Tel. & Tel. (New York)	137⅞	139⅜
General Electric (New York)	155⅝	153½
Kings County Electric (New York)	129	129
Postal Telegraph and Cables common (New York)	79	79
Postal Telegraph and Cables preferred (New York)	69⅞	68
Western Union (New York)	80⅝	78
Westinghouse common (New York)	68	66
Westinghouse preferred (New York)	117½	114
Edison Electric Illuminating (Boston)	296	294
Massachusetts Electric common (Boston)	22½	21¾
Massachusetts Electric preferred (Boston)	96	95
New England Telephone (Boston)	153	152
Electric Company of America (Philadelphia)	12	12
Electric Storage Battery common (Philadelphia)	53	53
Electric Storage Battery preferred (Philadelphia)	53	53
Philadelphia Electric (Philadelphia)	17¼	16⅞
Chicago Telephone (Chicago)	137½	136
Commonwealth Edison (Chicago)	136	135¼
National Carbon common (Chicago)	110	110
National Carbon preferred (Chicago)	118	118

PROPOSALS.

POST OFFICE AT GOSHEN, IND.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until February 7, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring, and lighting fixtures), of a one-story and basement brick and stone-faced building, covering approximately 5,000 square feet ground area, for the post office at Goshen, Ind. Drawings and specifications, may be obtained from the custodian of the site or the office of the Supervising Architect.

ELECTRICAL SUPPLIES.—Proposals will be received until January 23 by the Navy Department, Bureau of Supplies and Accounts, for the following material to be supplied to the Navy Yard at Brooklyn, N. Y. Schedules may be obtained from the Navy Pay Office nearest each Navy Yard. In making application the schedule number should be given.

Article.	Quantity.	No.
Boxes, distribution, etc.	Miscel.	4238
Conduit, steel	Miscel.	4238
Cord, incandescent-lamp	30,000 ft.	4230
Fans, 60-cycle	65	4238
Fittings, conduit, brass	Miscel.	4238
Fittings, conduit, steel	Miscel.	4238
Fittings, interior	1,800	4238
Hangers, insulator	Miscel.	4238
Jacks, water-tight	150	4238
Plugs, attachment	Miscel.	4238
Rings and sockets, rubber	Miscel.	4238
Semaphores, two-arm	20	4238
Sockets, lamp, etc.	Miscel.	4238
Switches and receptacles	200	4238
Unions, conduit, malleable iron	Miscel.	4230
Wire, lead-covered	Miscel.	4230
Wire, single conductor	Miscel.	4238

CONSTRUCTION AND EQUIPMENT OF POST OFFICE.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until January 29, 1912, and then opened, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring, and lighting fixtures) of a two-story and basement building of approximately 6,565 square feet ground area; stucco faced with stone and terra-cotta trimming, and fireproof construction, except the roof, for the United States post office at Santa Barbara, Cal., in accordance with drawings and specifications, copies of which may be obtained from the custodian of the site at Santa Barbara, Cal., or at the office of the Supervising Architect.

NEW INCORPORATIONS.

CHICAGO, ILL.—The Cline Electric Manufacturing Company has been incorporated with a capital stock of $10,000, to do a general electrical manufacturing and contracting business. N. H. Cline, J. W. Saul and S. H. Updike are the incorporators.

PORTLAND, ME.—The Eastern Texas Electric Company has been incorporated with a capital stock of $4,000,000, to construct and operate electric roads and supply water, light and heat. C. E. Eaton is president and T. L. Croteau, treasurer, both of Portland.

MARIETTA, OHIO.—The B. S. Sprague Electrical Company has been incorporated with a capital stock of $10,000, to engage in the manufacture and sale of electrical, gas and blasting materials, dealing in electrical fixtures and appliances. Harry T. Sprague, P. O. Sprague, Allen T. Williamson, S. A. Millikan and Elva Martin are the incorporators.

ALBANY, N. Y.—The Adirondack Electric Power Corporation, with headquarters at Saratoga, has been incorporated with a capital of $12,000,000 to acquire the property of the Hudson River Water Power Company and several other up-state electrical corporations. The directors are John P. Reynolds, Francis M. Edwards, James R. Hooper, Boston; Senator Edgar T. Brackett, Saratoga; Edward S. Webster, Chestnut Hill, Mass.; Wilson A. Shaw, Charles E. Willock, Pittsburgh, and John S. Scully, Washington.

DATES AHEAD.

American Institute of Consulting Engineers. Annual meeting, New York City, January 16.

Electrical Contractors' Association of New York State. Annual meeting, New York City, January 16.

Peoria Electric Show. Peoria, Ill., January 22 to 27.

Northwestern Cedarmen's Association. Minneapolis, Minn., January 23 and 24.

Western Electrical Inspectors' Association. Milwaukee, Wis., January 23-25.

Illinois Electrical Contractors' Association. Chicago, Ill., January 29.

National Independent Telephone Association. Annual convention, Chicago, Ill., February 7, 8 and 9.

Wisconsin State Telephone Association. Annual meeting, Madison, Wis., February 14-15.

Northwestern Electric Show, Minneapolis, Minn. March 16-23.

Minnesota Electrical Association. Minneapolis, Minn., March 20-22.

National Electric Light Association. Next annual convention, Seattle, Wash., June 10-14.

American Institute of Electrical Engineers. Annual convention, Boston, Mass., June 25 to 28.

National Electrical Contractors' Association. Annual meeting, Denver, Colo., July 17-20.

The 1912 Boston Electric Show. Mechanics Building, Boston, Mass., September 28-October 26.

With the Electrical Manufacturers

THE KERR TURBINE COMPANY, Wellsville, N. Y., announces the appointment of the following new agents: St. Louis, Walter L. Flower, 312 South Eighth Street, and New Orleans, G. E. Grevemberg, 1023 Maison Blanche Building.

THE FEDERAL SIGN SYSTEM (ELECTRIC), Home Insurance Building, Chicago, in the January issue of the *Federalist*, features, the "Sign Socket with the Lock Clamp." Bulletin No. 550 lists a 20-per-cent reduction in sign socket prices.

THE WESCO SUPPLY COMPANY, St. Louis, Mo., has issued the first issue in 1912 of its house organ, "The Red Shield." It calls particular attention to Peerless Mazda lamps, Sherarduct, Keystone wires and cables, as well as a large number of its specialties.

ARTHUR P. PIERSON, 136 Liberty street, New York City, has issued a new catalog of Peco specialties and Gemco heating devices. Among these are included pull-chain attachments, bell-ringing and toy transformers, lamp colorings, soldering aids, toasters, flat-irons and heating pads.

THE M. W. DUNTON COMPANY, 65 Atlantic avenue, Providence, R. I., points out in one of its circulars the advantages that have created so large a demand for its Nokorode soldering paste. The company pays for practical suggestions that may aid in soldering work of all kinds.

THE THOMPSON ELECTRIC COMPANY, 337 Superior Avenue, N. W., Cleveland, Ohio, is distributing a new bulletin describing the Thompson automatic safety cutout hangers for arc lamps. This permits the lamp to be cut out of circuit and lowered to the ground for trimming.

THE PHILADELPHIA ELECTRIC COMPANY SUPPLY DEPARTMENT, Philadelphia, Pa., has on the press a new catalog which is a complete reference book relating to lighting supplies. The catalog comprises 850 pages, and will be handsomely and substantially bound in cloth.

THE W. S. BROWN ELECTRIC COMPANY, 3 West Twenty-ninth street, New York, N. Y., beginning January 1, 1912, represents the Bossert Company of Utica, N. Y., in the eastern territory. The Bossert Company manufactures the Bossert knock-out boxes for rigid conduit, flexible conduit and enamel conductors.

THE DEARBORN DRUG AND CHEMICAL WORKS, McCormick Building, Chicago, is distributing a large wall calendar for 1912. It shows on the different monthly sheets various views in the offices, laboratories and factory that give a good idea of the vastness of this company's facilities for boiler-feed water treatment.

THE SCOTT-ROSE COMPANY has been organized in Chicago and has established headquarters in Suite 1651,

Marquette Building. The company will devote its energies to engineering work of all kinds, particularly electrical, mechanical, automobile and manufacturing. Semple S. Scott is president and H. Rose secretary and treasurer.

THE ELECTRIC SERVICE SUPPLIES COMPANY, Seventeenth and Cambria streets, Philadelphia, Pa., in its January "Keystone Traveler" features in its usually attractive way a number of electric-railway specialties, such as strain insulators, truss insulator pins, trolley catchers and retrievers, crossing signals, cable bonds and the Automotoneer.

THE MONARCH TELEPHONE COMPANY OF IOWA has been organized at Fort Dodge, Iowa, with a capital stock of $150,000. The company takes over the business of the Monarch Telephone Company of Chicago and will start manufacturing all kinds of telephone equipment at Fort Dodge. About 200 employees will probably be engaged when operations are in full swing.

THE LEEDS & NORTHRUP COMPANY, 4901 Stenton Avenue, Philadelphia, Pa., in catalogue No. 46, describes the Carey Foster bridge and N. B. S. and Reichsanstatt resistance standards. The theory of the Carey Foster method is lucidly worked out, the mechanical design of the bridge explained and the general uses and practice directions for using are demonstrated.

CHAS. H. THRALL & COMPANY, Havana, Cuba, announce the dissolving of this firm at the termination of their partnership agreement, December 31, 1911. The firm was composed of Chas. H. Thrall and J. P. Hall, and their New York offices were at 73 Warren Street. Mr. Hall, who signs the announecment, states that all communications for the present should be addressed to the firm at Havana.

THE TOLEDO ELECTRIC WELDER COMPANY, Cincinnati, Ohio, has published a catalog of its electric butt-welding machines. Nearly thirty of these devices are illustrated and fully described. The machines are self-contained and equipped with all the facilities necessary for turning out work of all kinds accurately and speedily. The catalog also gives much valuable information about electric welding in general.

THE SIMPLEX RAILWAY APPLIANCE COMPANY, Hammond, Ind., a corporation organized under the laws of Delaware capitalized at $1,000 000, has been admitted to do a manufacturing business in Indiana. The company, whose chief place of business will be in Hammond will manufacture street, interurban and steam passenger cars, trucks, wheels, etc., and do a general supply manufacturing business. Harry H. Phillips is president and Paul A. Neuffer, secretary. S.

THE S. K. F. BALL BEARING COMPANY, New York, N. Y., has opened an office in Chicago to facilitate the handling of Western business. The new office will be at 1505 Heisen Building, in charge of C. A. Winn. The company recently issued a bulletin on "SKF Radial Bearings," which explains the construction peculiarities, particularly the provision for self-alinement, of SKF radial bearings and gives dimensions, speeds and capacities of the principal types and sizes.

W. N. MATTHEWS & BROTHER, of St. Louis, Mo., have issued a new folder showing some half-dozen views in Delmar Garden, St. Louis, where Matthews guy anchors were readily installed in very difficult situations and have given excellent satisfaction. An important aid in this installation was secured through the use of the new wrench with removable handles and the special ratchet handle which permits the anchors to be placed close to walls, posts, etc., and to be driven full depth into the ground.

THE FLEXLUME SIGN COMPANY, Buffalo, N. Y., has ready for distribution a new catalog describing and illustrating its prismatic sign. In this sign the letters or other display are of prismatic glass moulded in bold reilief to any design. The outer face is of smooth finish, rendering the lodgement of dust unlikely, and making the sign one easily kept clean. The sign presents a handsome and effective daylight appearance and is a current-saver according to the claims made by the manufacturers. Full information supplied upon request.

THE I. W. T. WIRELESS COMPANY, 1040 Broadway, Brooklyn, N. Y., has issued the third edition of its general catalog of electrical and wireless telegraph supplies. These cover the full range of equipment needed by any wireless amateur for sending as well as receiving. The company handles complete outfits and also all the individual pieces of apparatus and supplies required. This company also deals in supplies of all kinds for building model aeroplanes.

THE REYNOLDS ELECTRIC FLASHER MANUFACTURING COMPANY, 617 West Jackson Boulevard, Chicago, has a new wrinkle in flashing devices for night illumination of advertising signs and bulletins. This consists, essentially, of double mirror-lined reflectors containing two lamps (one red and one white) controlled by a flasher, changing the color of the bulletin from white to red, to pink, to white, etc., one color dissolving into the other. Full details may be secured from the company upon request.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has received an order for the complete equipment of three rotary-converter substations and one transformer substation on the Kansas City, Clay County & St. Joseph Railway. The transformer station will contain three 750-kilowatt, twenty-five-cycle 6,600-33,000-volt, oil-insulated, self-cooled transformers. Each rotary converter substation will have six similar transformers and two 500-kilowatt 1,200-volt direct-current rotary converters. The Georgia Railways & Electric Company of Atlanta, Ga., has ordered twenty-seven double equipments of No. 112-B car motors with type K-35 controllers.

FOREIGN TRADE OPPORTUNITIES.

NO. 7798. TELEPHONE APPLIANCES AND ELECTRIC BELLS. An American Consul in the near East reports that a leading importer of his district desires to be put in touch with American manufacturers of telephone appliances, electric bells and accessories.

Record of Electrical Patents.

Issued by the United States Patent Office, January 2, 1912

1,013,108. Electrical Apparatus. John M. Barr, assignor to Westinghouse Electric & Manufacturing Co. A regulating anto-transformer whose secondary turns can be reeled from one coil to another coil on the opposite leg of the core.

1,013,112. Telephone Attachment. L. Bennett, New York, N. Y. A desk telephone has an adjustable arm for holding the receiver to the user's ear.

1,013,119. Single-Phase Motor. W. J. Branson, assignor to Westinghouse Electric & Manufacturing Co. The primary winding is in two sections, one giving two and other four poles. An anxiliary winding in three sections is used in starting.

1,013,123. Electric Measuring Instrument. H. W. Brown, assignor to Westinghouse Electric & Manufacturing Co. A differential voltmeter with one common negative terminal and two independent positive terminals, each circuit containing a high and a low resistance and the moving coil serving to interconnect the circuits between the resistances.

1,013,124. Machine for Making Incandescent Lamps. W. R. Burrows, assignor to General Electric Co. An exhausting machine with a pump, a heater and means for making electrical connection to the leading-in wires in the bulbs.

1,013,133. System of Electrical Distribution. F. Darlington, assignor to Westinghouse Electric & Manufacturing Co. Includes a number of circuit-breakers for connecting adjacent sections of a sectionalized conductor.

1,013,135. Incandescent-Lamp Socket. F. C. De Reamer, assignor to General Electric Co. The cap and shell are provided with bayonet slots, holding lugs and locking means.

1,013,149. Electric Motor. J. D. Forrer, assignor to Westinghouse Electric & Manufacturing Co. An inclosed motor with ball bearings for the armature shaft.

1,013,150. Transformer. C. L. G. Fortescue, assignor to Westinghouse Electric & Manufacturing Co. The core has an eccentric coil-receiving opening and is composed of layers each comprising a number of sections, one of which has a relatively narrow side limb that extends the full length of the core.

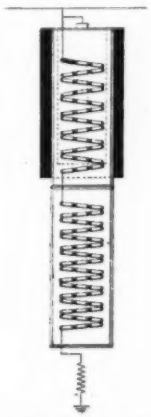
1,013,157. Resistance or Heating Element. W. S. Hadaway, Jr., assignor

to Westinghouse Electric & Manufacturing Co. Comprises a single folded resistance ribbon having short sections of relatively great rigidity which are secured to the adjacent folded portions.

1,013,166. Lightning Arrester. R. B. Ingram, assignor to Westinghouse Electric & Manufacturing Co. Consists of a long zigzag series of non-arcing metal blocks separated by air gaps; a metal shield is placed near the upper blocks.

1,013,167. Electric Circuit-Interrupter. R. P. Jackson, assignor to Westinghouse Electric & Manufacturing Co. Has a link and flexible shunt between one of the starting contacts and the movable bridging contact; a spring facilitates initial separation and final engagement of the contacts.

1,013,186. System of Electrical Distribution. P. M. Lincoln, assignor to Westinghouse Electric & Manufacturing Co. A high-tension distributing circuit is connected to a low-



1,013,166.—Lightning Arrester.

tension receiving circuit through a delta-connected transformer; to the secondary of this is joined a star-connected anxiliary transformer with its neutral grounded.

1,013,189. Electric Furnace. F. Louvrier, Mexico, Mex. Has one common electrode in the base and opposite pairs of electrodes in the two sides, switches permitting any number of side electrodes to be used.

1,013,216. Dynamo-Electric Machine. C. A. Psilander, assignor to Westinghouse Electric & Manufacturing Co. A railway motor mounted upon a quill has air inlets at one end and peripheral outlets and additional outlets for the armature to discharge its ventlating air between the quill and axle.

1,013,218. Induction Motor. W. E. Reed, assignor to Westinghouse Electric & Manufacturing Co. Starts as a repulsion motor, a short-circuiting device cutting out the brushes when full speed is nearly attained.

1,013,223. Detector. F. G. Sargent, Westford, Mass. A wireless receiver having a wire supported adjustably near its ends and engaging an intermediate variable contact.

1,013,227. Mounting Tungsten Filaments. C. F. Scott, assignor to Westinghouse Lamp Co. Helical coils are loosely carried by the supporting wires, and engage the hooked ends of the filament.

1,013,241. Insulator. F. C. Van Etten, Davenport, Ia. Three insulating sectors with wire-receiving recesses in their radial sides are held in a circular clamp.

1,013,245. Controlling Device for Explosive Engines. G. H. Watt, assignor to Watt Motor Co., Detroit, Mich. Relates to the electric ignition systen of a four-cycle engine.

1,013,250. Insulator Pin. W. J. Wilson, Pittsburgh, Pa. A tubular sheet-metal pin divided into two parts longitudinally and having a driving point at one end and an insulator-engaging thread at the other.

1,013,270. System of Electrical Distribution. R. Braun, assignor to Westinghouse Electric & Manufacuring Co. Includes a load equalizer consisting of two induction machines, whose rotors are mechanically connected to a common flywheel and electrically to a resistance and speed regulator.

1,013,290. Electrically Controlled Semaphore. E. R. Gill, assignor to H. E. Merrell, New York, N. Y., and O. J. Hamlin, Smethport, Pa. The semaphore is electromechanically controlled by a pair of selectors answering to different line impulses.

1,013,305. Grounding Device for Electrical Conductors. F. W. Pardee, assignor to Paragon Sellers Co., Chicago, Ill. A grounding cone of perforated sheet metal containing hygroscopic material.

1,013,327. Electric Heater. R. Smith, Cleveland, Ohio. A tubular casing contains an incandescent lamp.

1,013,331. Device for Controlling the Synchronism of Two Motors. F. E. Thormeyer, Hamburg, Germany. The motor armatures are joined by an auxiliary conductor including a variable resistance.

1,013,352. Arc-Lamp Construction. M. J. Wold, and H. Hertzberg ,assignors to Abbot A. Lowe, Horseshoe, N. Y., Maurice J. Wohl, New York, N. Y., and Harry Hertzberg, Brooklyn, N. Y. Relates to means for supporting the globe.

1,013,359. Electric Furnace. M. Appel, Baltimore, Md. A resistance furnace mounted for oscilation comprises a number of metal baths electrically interconnected at their surfaces and combined with metallic electrodes.

1,013,380. Electrically Controlled Bag-Filling and Weighing Device. W. R. Dunn, Easton, Pa. When the weight reaches the desired point, an electromagnet closes the valve in the delivery chute.

1,013,409. Trimmer and Gage for Arc Lamps. A. A. Low, Horseshoe, and H. Hertzberg and M. J. Wohl, New York, N. Y. Comprises a handle having a cup-shaped portion at one end, and a rod mounted in the handle.

1,013,412. Party-Line Telephone System. A. Marchand, Bridgeport, Wash. Permits the connection of two parties on the same line and the locking out of the others.

1,013,434. Electric-Lamp Socket. M. Peaucellier, Paris, France. A sign body of plastic insulating material is provided with a number of socket cavities arranged at intervals in its length.

1,013,445. Method of Manufacturing Electrodes. H. Rodman, assignor to Electric Storage Battery Co. Philadelphia, Pa. Planté storage-battery plates made by molding a barium-lead alloy into suitable shape, converting part of the lead into active material and reducing part of the barium to an inert salt.

1,013,465. Battery-Charge Indicator. E. Van Wagenen, assignor to Gould Storage Battery Co. In the circuit of a recording meter connected across a storage battery are two resistances bridged by a contact that is varied by the density of the electrolyte.

1,013,466. Sparking Apparatus. H. F. Whalton, Key West, Fla. A timer and distributor for an ignition circuit.

1,013,473. Vehicle Brake. H. E. F. R. Block, Copenhagen, Denmark. Includes an emergency means for breaking the ignition circuit of an automobile.

1,013,305.—Ground Cone.

1,013,485. Station Indicator. M. Godfrey, R. Ekron, and H. M. Svebilius, Chicago, Ill.; said Godfrey and Svebilius assignors to said Ekron. The winding of an indicating sheet from one to another reel is controlled by electromagnets.

1,013,494. Electromotor. B. F. Hutches, Jr., Allendale, N. J. A barrel has a pair of conducting rings encircling it; an electromagnet makes and breaks the contact between them.

1,013,534. Floor-Surfacing Machine. H. W. Cheney, Norwood, Ohio. Is driven by a variable-speed reversible motor.

1,013,569. Electric Switch. P. L. Sibole, Swissvale, Pa. Has three movable switch elements, one intermediate the other two and all adapted to move up to or away from the others.

1,013,572. Method of Shaping Filaments. R. W. Suman, assignor to General Electric Co. Tungsten wire is wound back and forth between two supports so as to resemble the figure 8.

1,013,574. Magnetic Chuck. O. S. Walker, Worcester, Mass. The shell has a central and outer concentric cores with magnitizing windings about them.

1,013.589. Combined Piano-Player and Talking Machine. W. M. Davis, New York, N. Y. The talking machine electrically controls the motor-starting and speed-controlling device.

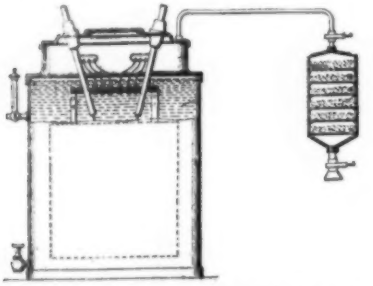
1,013,599. Incandescent Filament. D. Hand, assignor to General Electric Co. The manufacture of metallized-carbon filaments consists in firing a carbon filament impregnated with sodium chloride to a high temperature to expel the chloride and prepare it for coating with metallizable carbon.

1,013,658. Electric-Lamp Socket. A. L. Jacobs, assignor to J. M. Jacobs, Boston, Mass. The base has two insulating blocks between which is the key-switch mechanism.

1,013,673. Trolley Pole. M. Melinski, Albert City, Ia. The pole is pivotally mounted on a revolvable post and disk from which an arm extends horizontally; a spring connects the ends of the arm and pole.

1,013,681. Lamp Socket. R. W. Osland, Plainfield, N. J., and M. J. Huggins, Brooklyn, N. Y. A porcelain socket body and cap are interconnected by a key.

1,013,753. Squirrel-Cage Rotor for Electric Motors. G. Dunn, assignor to Crocker-Wheeler Co., Ampere, N. J. Has a number of oblique overlapping segments each having openings which tightly engage the ends of the intermediate conductor bars which it spans.



1,013,767.—Dry-Air "Breathing" Device for Outdoor Transformers.

1,013,754. Electric Controller. A. C. Eastwood, assignor to Electric Controller & Manufacturing Co., Cleveland, O. Has a number of solenoid switches, each of whose windings is included in the control circuit on the closing of the preceding switch.

1,013,767. Means for Preventing Moisture From Entering Transformer Tanks. F. W. Hadley, Atlanta, Ga. The air space above the oil in the transformer has an outlet to permit air to pass out only and an inlet and pipe connected to a drying chamber to insure dry air only being admitted.

1,013,780. Centrifugal Switch for Alternating-Current Motors. T. Kargau, assignor to Peerless Electric Co., Warren, O. As soon as the speed attains a desired value after starting, the brushes are removed from the contact segments.

1,013,800. Apparatus for Conducting Thoracic Operations. W. Meyer and J. Meyer, New York, N. Y., assignors to the people of the United States. A surgical apparatus comprising in combination two chambers of airtight construction having an opening between through which the head of a patient may project, and electrical means for varying the air pressure in both chambers, motor-driven pumps being used.

1,013,854. Thermostat. G. P. Wild, assignor to F. W. Schmidt, Philadelphia, Pa. Has a concrete casing containing an acid-resisting electrode connected to the circuit.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired January 8, 1912:

532,016. ELECTRICALLY-PROPELLED VEHICLE. Henry C. Baker and John R. Elberg, Kansas City, Mo.

532,057. MOTOR SUSPENSION FOR ELECTRIC STREET CARS. Samuel Harris, Cleveland, O.

532,095. ELECTRIC ARC LAMP. Amos W. Richardson, Patricroft, England.

532,101. INSULATOR FOR ELECTRIC WIRES. Daniel M. Rothenberger, Lancaster, Pa.

532,103. ELECTRIC LAMP SUPPORT. Frank Schefold and James Nortney, New Albany, Ind.

532,113. CONVERTER SYSTEM FOR ELECTRIC RAILWAYS. George W. Swartz, Florence, Ala.

532,126. SUPPLY SYSTEM FOR ELECTRIC RAILWAYS. Albert G. Wheeler, Chicago, Ill.

532,128. STORAGE BATTERY. Theodore A. Willard, Norwalk, O.

532,161. CONDUCTOR. Myron D. Law, Washington, D. C.

532,164. CONDUCTOR SUPPORT. John C. Love, Chicago, Ill.

532,165. CONDUIT FOR ELECTRIC RAILWAYS. John C. Love, Chicago, Ill.

532,166. TENSION DEVICE FOR ELECTRIC CONDUCTORS. John C. Love, Chicago, Ill.

532,167. ELECTRIC - RAILWAY TROLLEY. John C. Love, Chicago, Ill.

532,168. TROLLEY-WIRE CLIP. John C. Love, Philadelphia, Pa.

532,185. CONDUCTOR - BOND FOR MEETING ENDS OF RAILS OF ELECTRIC RAILWAYS. Peter Rieth, Chicago, Ill.

532,188. ELECTRIC HAIR-CLIPPING MACHINE. Peter Shannon, Chicago, Ill.

532,200. TROLLEY FOR ELECTRIC RAILWAYS. John C. Henry, Westfield, N. J.

532,260. CROSS-ARM FOR SUPPORT OF ELECTRIC WIRES. Edward J. Bulock, Wallingford, Conn.

532,261. CONDUIT ELECTRIC RAILWAY. Albert M. Burgher, Clay City, Ky.

532,291. ELECTRIC BURGLAR-ALARM. Horace M. Scholes and George M. Myers, Kansas City, Mo.

532,302. CLOSED CONDUIT FOR ELECTRIC RAILWAYS. Frank Windale, Philadelphia, Pa.

532,353 and 532,354. LIGHTNING ARRESTER. Alexander J. Wurts, Pittsburg, Pa.

532,391. ELECTRIC-LAMP SUPPORT. James Nortney, New Albany, Ind.

Patents Expired January 1, 1912.

531,650. TELEPHONE INDICATING APPARATUS. John L. Sabin and William Hampton, San Francisco, Cal.

531,651. ELECTRIC BLOCK-SIGNAL. Charles H. Sallada, Pittsburgh, Pa.

531,657. TRANSMUTER FOR ELECTRICAL CURRENTS. William J. Still, Toronto, Canada.

531,663. BASE FOR INCANDESCENT ELECTRIC LAMPS. George C. Thomas, South Framingham, Mass.

531,664. CLOSED CONDUIT FOR ELECTRIC RAILWAYS. Robert J. Turnbull, St. Paul, Minn.

531,669. INDICATOR FOR ELECTRIC CURRENTS. Edward Weston, Newark, N. J.

531,698. ELECTRIC ARC LAMP. Charles A. Pfluger, Chicago, Ill.

531,702. CLEAT FOR ELECTRIC WIRING. Joseph H. Swift and William F. Maintien, Plainville, Mass.

531,707. BRUSH FOR DYNAMO-ELECTRIC MACHINES. John B. Wallace, Ansonia, Conn.

531,708. ELECTRIC SIGNAL. William J. Wessenberg, and Horatio F. Wilbur, Meriden, Conn.

531,709. ELECTROMAGNET. William J. Wessenberg and Horatio F. Wilbur, Meriden, Conn.

531,751. ELECTRIC ARC LAMP. Albert Schweitzer, Allegheny, Pa.

531,761. CUT-OUT BOX. George H. Alton, Lynn, Mass.

531,764. ELECTRIC CAR-LIGHTING APPARATUS. William Biddle, Brooklyn, N. Y.

531,765. CIRCUIT - REGULATING DEVICE IN ELECTRIC CAR-LIGHTING APPARATUS. William Biddle, Brooklyn, N. Y.

531,790. METHOD OF OPERATING OR CONTROLLING ELECTRIC MOTORS OR DYNAMOS. Rudolf Eickemever, Yonkers, N. Y.

531,821. CONSTANT - CURRENT DYNAMO. James J. Wood, Fort Wayne, Ind.

531,840. ADJUSTING MECHANISM FOR ARC-LIGHT CARBONS. Elie F. G. H. Faure, Schenectady, N. Y.

531,849. ELECTRIC STEAM-ENGINE GOVERNOR. Chester B. Melott, Rondout, N. Y.

531,866. METHOD OF AND MEANS FOR MEASURING ENERGY OF ALTERNATING ELECTRIC CURRNTS. Oliver B. Shallenberger, Rochester, Pa.

531,867. METHOD OF AND MEANS FOR MEASURING ALTERNATING ELECTRIC CURCURENTS. Oliver B. Schallenberger, Rochester, Pa.

531,868. INDICATING WATTMETER FOR ALTERNATING ELECTRIC CURRENTS. Oliver B. Shallenberger, Rochester, Pa.

531,869. WATTMETER FOR MULTIPHASE ALTERNATING ELECTRIC CURRENTS. Oliver B. Shallenberger, Rochester, Pa.

531,870. ALTERNATING - CURRENT MEASURING INSTRUMENT. Oliver B. Shallenberger, Rochester, Pa.

531,873. ELECTRIC RAILWAY. Abraham A. Shobe and William Embley, Jerseyville, Ill.

531,890. COIN - CONTROLLED ELECTRICAL MUSICAL INSTRUMENT. Philip Wuest, Jr., Philadelphia, Pa.

531,913. TELEPHONE SWITCH. Augustus G. Davis, Baltimore, Md.

531,919. ELECTRIC RAILWAY-SIGNAL. Jake Frank, New York. N. Y.

531,929. SAFETY DEVICE FOR ELECTRIC CIRCUITS. Thomas Harden, London, England.

531,962. DISTRIBUTION OF ELECTRICITY. Thomas Parker. John H. Woodward and Edmund S. G. Rees, Wolverhampton, England.